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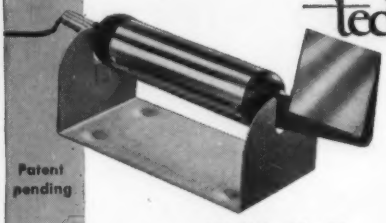

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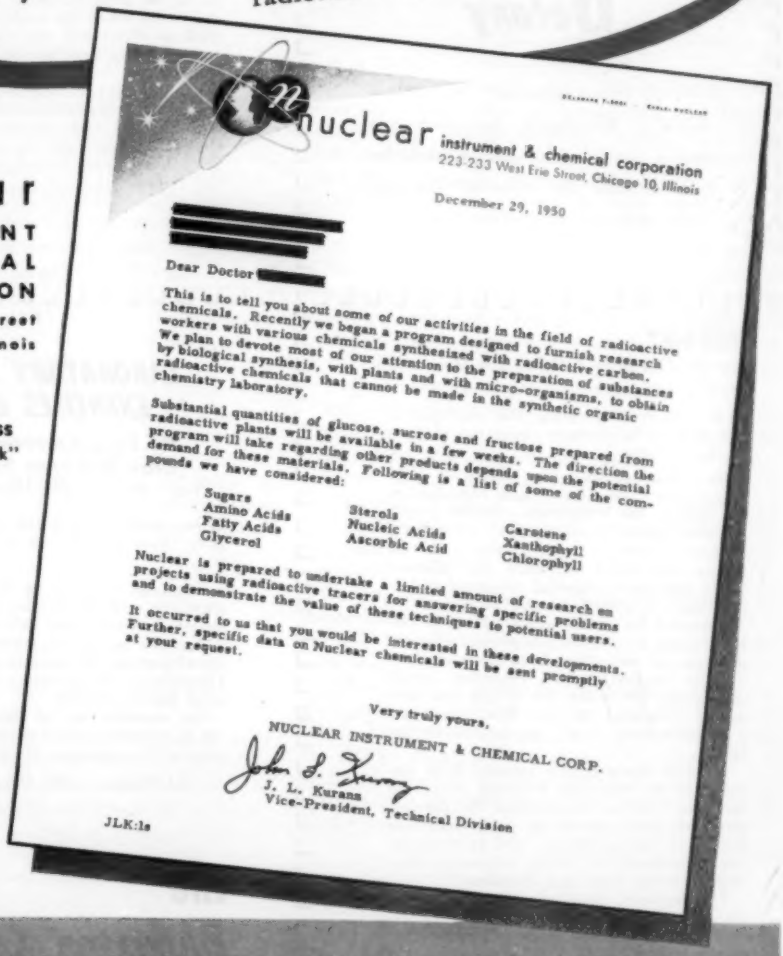

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[redacted]

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Systematics in Zoology

SYSTEMATIC zoology has been in eclipse for so many years and has been so little considered in scientific circles that it has almost lost its standing as one of the fundamental aspects of biology. Indeed, a proper perspective of the science has so largely been lost that some of its branches have been mistakenly accepted as separate sciences and accorded more respect and encouragement than the larger field of which each of them is but one part.

Thus, a few decades ago the branches of morphology and comparative anatomy flourished at the expense of other branches of systematics. And in the last few years the study of evolution has been so popular that the subject has assumed a dominant position in biological thought. That evolution is but one branch of systematics has seldom occurred to zoologists, many of whom have relegated "systematics" to the limbo of outmoded fads. Their own frequent dependence upon the varied work of systematists has seldom been recognized by them.

But systematic zoology has not been in decay. It has been pushing steadily toward the solution of some of the most fundamental of biological problems, content to let other aspects of biology and even some of its own diverticula hold the limelight. It has been assembling data that have been used by many other disciplines with little thought to its source.

Systematists have not felt a need to justify their science, but they have recognized the lack of appreciation and understanding resulting from the belief of other zoologists that it was no longer a basic, important, and indispensable part of biological science. This recognition of the undeserved position to which it has been relegated has led to a resurgence of interest in principles and in the problems of systematics as part of biology.

A major step in implementing the awakening interest and self-assertion is the organization of a Society of Systematic Zoology to bring together all systematists and to help restore the science to its rightful place. The widespread interest in this society is shown by its growth in membership in three years to over 800, and by the confident expectation that it will pass 1,000 in another year. The determination of the society to exert the utmost influence on zoological thought and practice is shown by its current program, which includes publication of a new journal on principles and procedures, sponsorship of a book on the foundations of systematics, and encouragement of the interchange of ideas among systematists.

Improving the education of systematists and the instruction of other zoologists in the contributions and potentialities of systematics are major aims, as well as assuring that the importance of their work and the fundamental nature of the subject are acknowledged. The place of books in systematics is recognized in the program in the exhibit of recent books at national meetings.

One example of current work in systematics is the forthcoming 1,000-page volume by W. K. Gregory, entitled "Evolution Emerging." In dealing not so much with evolutionary principles as with the results of evolution (classification), this work would qualify as a major systematic paper even in a restricted sense of the word. Although dealing primarily with vertebrates, the origins of animal groups and the principles of evolution revealed in these origins are treated. The bibliography of 5,000 titles will make this a major source book in evolution of the vertebrates.

RICHARD E. BLACKWELDER
U. S. National Museum, Washington, D. C.

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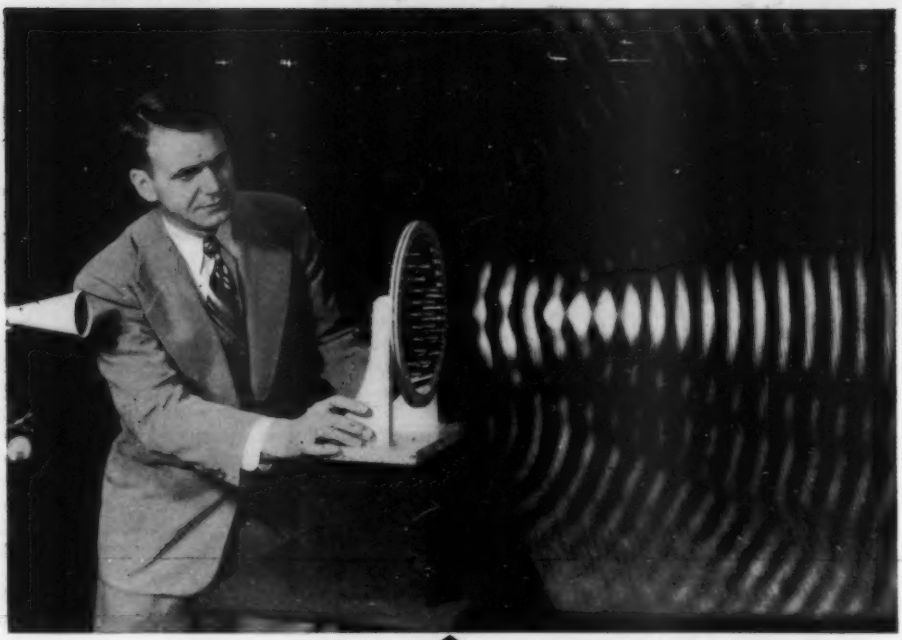

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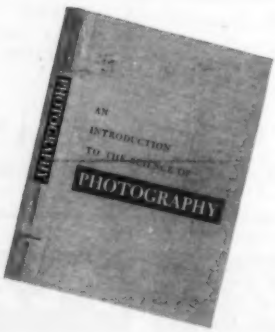

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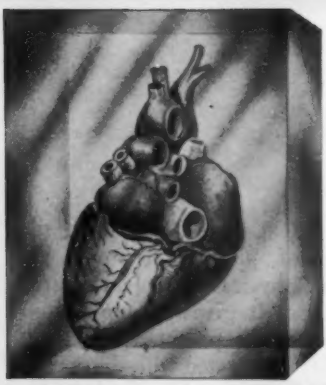

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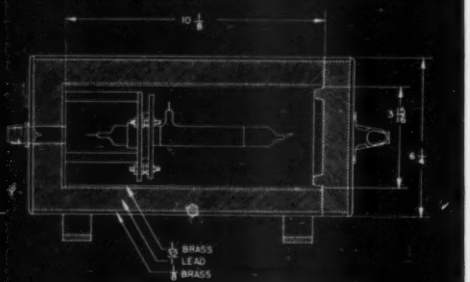

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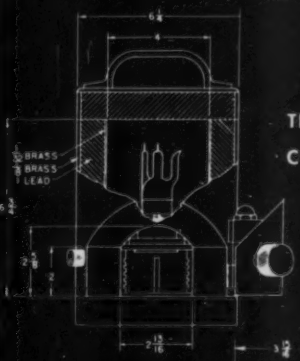

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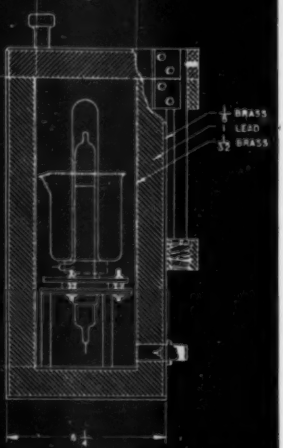

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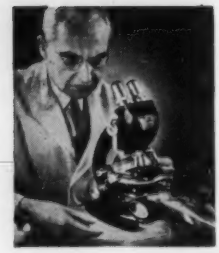

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J. R. Arnold and W. F. Libby[2]

Institute for Nuclear Studies, University of Chicago, Chicago, Illinois

THE DATES OBTAINED during the past eighteen months by the radiocarbon technique are listed below. The dates quoted are based on 5568 ± 30 years as the half-life of radiocarbon—a new value resulting from a correction we recently made on our earlier determination (5720) and from an averaging with the best other published values. The number of runs is indicated by the number of dates listed. The errors quoted are standard deviations consisting solely of the error of counting random events. Naturally, other errors are involved, so the true error will be somewhat larger. The scatter appears to be little more than would be expected from the errors quoted, so perhaps one can conclude that the counting error is still dominant, and longer counting periods would pay. In this connection the counting time has been limited to 48 hours in order to accommodate the number of samples necessary to the over-all check of the method, which was the main purpose of this research.

RADIOCARBON DATES

I. *Mesopotamia and Western Asia*
(Principal collaborators: R. J. Braidwood, T. Jacobson, Richard A. Parker, and Saul Weinberg.)

A. Egypt

Our No.	Sample	Age (years)
1	*Zoser*: Acacia wood beam in excellent state of preservation from tomb of Zoser at Sakkara. Known age 4650 ± 75 years, according to John Wilson. Submitted by Ambrose Lansing, Metropolitan Museum.	3699 ± 770 4234 ± 600 3991 ± 500 Av. 3979 ± 350
12	*Sneferu*: Cypress beam from tomb of Sneferu at Meydum. Known age 4575 ± 75, according to John Wilson. Submitted by Froelich Rainey, University of Pennsylvania Museum.	4721 ± 500 4186 ± 500 5548 ± 500 4817 ± 240 Av. 4802 ± 210

[1] The authors gratefully acknowledge the generous financial support afforded by The Viking Fund, Inc., New York City.

[2] The archaeological and geological significance of these results will be discussed by the donors of samples, collaborators, and the advisory committee, in articles in appropriate journals. The authors wish to thank Frederick Johnson, Donald Collier, Richard Foster Flint, and Froelich Rainey, the members of the Committee on Carbon 14 of the American Anthropological Association and the Geological Society of America for their indispensable direction and assistance throughout this research.

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
81	*Sesostris*: Funerary ship from tomb of Sesostris III. Known age 3750, according to John Wilson. Submitted by Col. C. C. Gregg, Chicago Natural History Museum.	3845 ± 400 3407 ± 500 3642 ± 310 Av. 3621 ± 180
62	*Ptolemy*: Wood from mummiform coffin from Egyptian Ptolemaic period. Known age 2280, according to John Wilson. Submitted by John Wilson and Watson Boyes, Oriental Institute, University of Chicago.	2190 ± 450
267	*Hemaka*: Slab of wood from roof beam of tomb of Vizier Hemaka, contemporaneous with King Udimu, 1st Dynasty, at Sakkara. Sample submitted by W. B. Emery, c/o British Embassy, Cairo. Accepted age 4700–5100, according to Braidwood.	4803 ± 260 4961 ± 240 Av. 4883 ± 200
463	*Predynastic*: Charcoal from point "A-15" of the house floors (*fonds de cabanes*) at El Omari, near Cairo, Egypt. Insofar as archeological material is available in published form, a typological assessment of the position of El Omari would be *ca.* midway between the time of the Upper K pits of the Fayum (457), and Hemaka (267). Submitted by Fernand de Bono, Service des Antiquités de l'Egypte, Cairo.	5256 ± 230
457	*Upper K*: Wheat and barley grain uncarbonized, with no preservatives added, from Upper K Pit No. 13 of the Fayum A material as described in *The Desert Fayum*, by Gertrude Caton-Thompson. Submitted by Miss Caton-Thompson and Elise Baumgartel, Museum of The University of Manchester.	6054 ± 330 6136 ± 320 Av. 6095 ± 250

B. Turkey

115	*Alishar*: Wood from the foundation cribbing for a fortification wall in Square 0-10 in III wall of the mound at Alishar, assigned by	3650 ± 350 2823 ± 350

Our No.	Sample	Age (years)
	the excavators to the Bronze Age. Reference, *Oriental Institute Publications XXVIII*, 209–10, Fig. 207. Submitted by R. J. Braidwood, Oriental Institute.	Av. 3212 ± 250
183	*Alishar Chalcolithic*: Wood from Level 14 (out of Levels 9–18). Reference, *Oriental Institute Publications XXVIII*. Submitted by R. J. Braidwood.	4519 ± 250
	C. Irak	
113	*Jarmo*: Land snail shells fairly well preserved from the basal Levels 7 and 8. Earliest village material of Mesopotamia and Western Asia. It is preceramic. Excavated and submitted by R. J. Braidwood.	6707 ± 320
	D. Syria	
72	*Tayinat*: Wood from the floor of a central room (I-J-1st) in a large Hilani ("palace") of the "Syro-Hittite" period in the city of Tayinat in northwest Syria. Known age 2625 ± 50 years, according to R. J. Braidwood. Submitted by him.	2696 ± 270 2648 ± 270 2239 ± 270 Av. 2531 ± 150
	E. Iran	
492 547	*Early Mesolithic*: Charred bone from Belt Cave in Iran; mixture of Layers 25, 26, 27, and 28. Early mesolithic. Submitted by C. S. Coon, University of Pennsylvania.	8004 ± 900
524	*Late Mesolithic*: Burned bone from Belt Cave in Iran; Layer 11; end of Mesolithic. Submitted by C. S. Coon.	10560 ± 1200
494 495 523	*Neolithic*: Burned bone from Belt Cave in Iran, Neolithic Layers principally 10, with a little of 6, 7, 8, and 9. Submitted by C. S. Coon. Comment: Large errors in the Belt Cave samples are attributable to small size.	8085 ± 1400
	II. *Western Europe*	
	(Principal collaborators: H. J. Movius, E. S. Deevey, Jr., and R. F. Flint.)	
	A. France	
406	*Lascaux*: Charcoal from the Lascaux Cave near Montignac northeast of Les Eyzies in the Dordogne. This cave has the remarkable paintings. The charcoal was taken from the occupation level by M. Severin Blanc in 1949 and consisted of conifer *Abies* or *Larex*, neither of which grow in cold climate. Submitted by H. J. Movius, Harvard.	15516 ± 900
	B. Germany	
337	*German Alleröd*: Peat with birch remains from pollen zone IIb, the younger Alleröd, from Wallensen im Hils, northwest Germany. Submitted by F. Firbas. Comment: Subaretic birch following glacial retreat.	11044 ± 500
450	*Overbeck Peat*: Peat from an accurately dated (2500–2700 years) dry period extending throughout northern Europe and associated with good archaeology. This sample was taken carefully from 0 to 2 cm below the dry horizon. Submitted by F. Overbeck. Comment: Essentially a known. Poor check.	1446 ± 250 1452 ± 290 Av. 1449 ± 200
	C. Denmark	
432	*Danish Boreal II*: Pine cones from Denmark (Seeland, Aamosen; Øgaarde-K, PØ. 1949). They are from pollen zone V, thought to be 8500 years old. Submitted by J. Troels-Smith, National Museum, Copenhagen. Comment: Seems to agree with pollen date.	7583 ± 380
433	*Boreal IV*: Hazelnuts from Denmark (Seeland, Aamosen; Kildegaard-K., Ul.Ø., house 1). The nuts are from one single summer dwelling, belonging to the late boreal age, pollen zone VI, thought to be about 8000 years old. Submitted by Troels-Smith. Comment: Considerably older than expected and out of line with 432 and 434.	9935 ± 440 9927 ± 830 Av. 9929 ± 350
434	*Danish Boreal III*: Charcoal from the same summer house as 433. Expected age about 8000 years. Submitted by Troels-Smith. Comment: Charcoal and hazelnuts do not appear to agree. Charcoal seems to fall closer to expected age.	8631 ± 540
	D. Ireland	
358	*Boreal II*: Peat from Clonsast, County Offaly, Ireland. Late Boreal Zone VIc. Should be later than Danish 432 and earlier than English 343. Submitted by G. F. Mitchell, Trinity College, Dublin. Comment: Fairly agreeable result.	5824 ± 300

Our No.	Sample	Age (years)
355	*Irish Mud*: Lake mud from Knocknaeran, County Monaghan, Ireland. Late glacial, pollen zone II. Submitted by G. F. Mitchell. Comment: Contemporaneous with the Two Creeks Mankato in America.	11310 ± 720
	E. England	
461	*Beeswax*: Lump of beeswax associated with a smith's hoard of late bronze age objects of estimated 2500–3000 years age. Submitted by J. W. Brailsford, British Museum. Comment: Not part of hoard; it is younger.	712 ± 200 926 ± 230 Av. 819 ± 160
347	*Shapwick Peat*: Modified humified peat (Sphagnum-Calluna) from Mid-Iron Age to Romano-British period, from Shapwick Heath, Somerset. Pollen zone VIII. Upper Oligotrophic layer; decay pool wood; collected Oct. 2, 1949–*cf.* S.H.6. Submitted by H. Godwin, Cambridge. Comment: Appears fairly reasonable.	3099 ± 250 3520 ± 300 Av. 3310 ± 200
343	*Shapwick Atlantic*: Humified Sphagnum-Calluna peat of Neolithic Age, early pollen zone VII, taken from 6′8″–7′ at base of old peat at Dewar's track excavation on Oct. 2, 1949. Submitted by H. Godwin, Cambridge. Comment: Should be older than 347 and younger than Danish 432.	6044 ± 380
462	*Mesolithic*: Piece of charred wood from the lakeside settlement at Ehenside Tarn, Cumberland. Neolithic "A" material. Conventional dating is 4000 years, *cf. Archaeologia*, **LXIV**, 280. One of rare cases in England where organic material has been preserved in association with characteristic Neolithic material. Submitted by J. W. Brailsford, British Museum. Comment: Appears to be a little older than expected.	4964 ± 300
353	*Starr Carr*: Wooden platform from Mesolithic site at Lake Pickering, Starr Carr, Yorkshire. Pollen zone IV. Collected July 1949. Submitted by H. Godwin. Comment: Looks too old.	10167 ± 560 8808 ± 490 Av. 9488 ± 350
340	*Post Glacial I*: Peat from Hawks Tor, Cornwall. Pollen zone IV. Collected from 7′–7′4″ at site 1 at base of upper peat Sept. 5, 1949. Submitted by H. Godwin.	8011 ± 400 8540 ± 780

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
	Comment: May be a little younger than 353.	Av. 8275 ± 350
349	*English Allerŏd*: Calcareous silty nekron mud from 790 to 825 cm at D.B.5, Hockham Mere, Norfolk. Late glacial, pollen zones II and III. Submitted by H. Godwin. Comment: Looks young.	6619 ± 380 6491 ± 420 Av. 6555 ± 280
444	*Godwin*: Lake mud from Neasham near Darlington in the extreme north of England. Pollen zone II, correlated directly with last glacial stage. Submitted by H. Godwin. Comment: Looks like Two Creeks Mankato.	10851 ± 630
341	*Allerŏd I*: Peat from Hawks Tor, Cornwall, late glacial, pollen zone II, 9′–9′4″ at site I, middle of lower peat. Submitted by H. Godwin. Comment: English and North American ice look contemporaneous.	9861 ± 500
479	*Ponders End*: Plant debris from Lea Valley Arctic Bed north of London at Ponders End. Glacial stage associated with mammoth, lemming, and arctic plants. Submitted by H. Godwin. Comment: Older than expected.	Older than 20,000 years
480	*Cambridge Interglacial*: Oak wood debris from interglacial period on Histon Road, Cambridge. Middle of last interglacial, time of maximum extension of the Eem Sea.	At least 17,000 years
	III. *United States*	
	(Principal collaborators: E. S. Deevey, Jr., R. F. Flint, J. B. Griffin, R. F. Heizer, F. Johnson, F. Roberts, and W. S. Webb.)	
	A. New England	
417	*Fishweir I*: Peat from Boylston Street fishweir site. Lower peat underlying the fishweir. Presumably the fishweir should be younger. Submitted by E. S. Barghoorn, Biological Laboratories, Harvard; (*cf.* pp. 60, 65, and 68, *The Boylston Street Fishweir II*).	5717 ± 500
418	*Fishweir II*: Fragment of coniferous wood from marine silt overlying the Lower Peat and the Fishweir. Submitted by E. S. Barghoorn. Comment: Fishweir may be contemporaneous with Frontenac, Lamoka, and ancient Kentucky sites.	3851 ± 390

Our No.	Sample	Age (years)
36–39	*Deevey Series*: A series of pond mud samples from Upper Linsley Pond in Connecticut, as described in E. S. Deevey, Jr., *Am. J. Sci.*, 241, 717–52 (1943). Samples were taken by boring through ice in center of pond. Collected and submitted by E. S. Deevey, Jr.	
	Sample / *Depth (m)* / *Pollen zone*: 36 / 5.5 / C 3	876 ± 250
	37 / 8.05 / C 2	1800 ± 500
	38 / 9.15 / C 1–C 2	5159 ± 350
	39 / 11.65 / C 1–B	8323 ± 400
	Comment: End of pine period (Zone B) appears to be about 8300 years in Connecticut.	
119–122	*Linsley Series*: Another series of mud samples from Upper Linsley Pond. These, however, were taken from the edge of the pond. Collected and submitted by E. S. Deevey, Jr.	
	Sample / *Depth (m)* / *Pollen zone*: 119 / 4.65 / C-2	2141 ± 250
	120 / 6.65 / C 1–C 2	5305 ± 250
	121 / 8.65 / C 1	Heterogeneous 6911 and 4088 ± 250
	122 / 10.15 / B	6668 ± 250
	Comment: Mixing appears to be involved.	
335	*Boreal I*: Peat from 6.0 m in Plissey Pond, Maine. Very top of pine zone B. Submitted by E. S. Deevey, Jr. Comment: Appreciably later than pine zone in Connecticut.	5962 ± 320
	B. New York State	
191	*Frontenac*: Charcoal from hearth in deepest refuse levels (Trench 4, Section 4) of Frontenac Island site (1939). This represents the Archaic period of the Frontenac Focus; (*cf.* W. A. Ritchie, *Research Trans. N. Y. Arch. Assoc.* **X**, 6 [1945]). Submitted by W. A. Ritchie, Rochester Museum of Arts and Sciences. Comment: Contemporaneous with oldest Kentucky mounds.	4930 ± 260
192	*Point Peninsula*: Charcoal from cremation (burial 6) on the Oberlander component No. 2 at Brewerton, Oswego Co., New York (1938). This is early Point Peninsula Focus; (*cf.* W. A. Ritchie, *Rochester Museum Arts and Sciences, Memoir 1*, 152–160 [1944]). Submitted by W. A. Ritchie.	2817 ± 270 3080 ± 200 Av. 2948 ± 170
367	*Lamoka III*: Charcoal from Lamoka Lake site in earliest occupation level 5′ below midden surface. Submitted by W. A. Ritchie.	5383 ± 250
288	*Lamoka*: Charcoal from hearth in subsoil under 5′ of undisturbed refuse at Lamoka Lake Site, Schuyler Co., New York. Some rootlets were present in this sample. They were segregated under a low-power magnifying glass. This sample was less carefully collected than 367. Submitted by W. A. Ritchie. Comment: Doubt that all rootlets were removed. In view of rootlets, perhaps the 5383 date for 367 should be taken. Contemporaneous with Frontenac.	4395 ± 350 4344 ± 300 Av. 4369 ± 200
	C. Iowa, Illinois, Kentucky, Pennsylvania, and Ohio	
116	*Webb I*: Annis mound, Kentucky, Archaic period, shell from the 6.5′ level. Shells powdery on surface but shiny and apparently untouched underneath. Submitted by W. S. Webb. Comment: Agrees with antler from same level (251).	5149 ± 300
180	*Webb IV*: Annis mound shell from the 3.0′ level. Submitted by W. S. Webb. Comment: Shells powdery and in poorer condition than those of 116.	7374 ± 500
251	*Deer Antler*: Annis mound deer antler from Archaic 6.5′ level. Submitted by W. S. Webb. Comment: Agrees with Frontenac and Lamoka Archaics.	4900 ± 250
254	*Indian Knoll*: Antler from Indian Knoll Oh2 mound at 1.0′ level. Submitted by W. S. Webb.	5709 ± 350 4894 ± 560 Av. 5302 ± 300
126	*Adena I*: Adena material from Drake Mound, Fayette Co., Kentucky, Site No. 11. Fragments of bark preserved by contact with copper reel-shaped breast plate, in association with Burial No. 7, lying on bottom of pit, the central feature of this site. Submitted by W. S. Webb.	1168 ± 150
214	*Ohio Adena*: Adena material from Cowan Creek mound, Ohio. Charcoal from subfloor fireplace just outside house structure. Submitted by R. S. Baby.	1509 ± 250

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
136	*Hopewell III*: Hopewell material from mound 25, Hopewell site, Ohio. Charcoal of sample No. 56,424. Submitted by G. Quimby, Chicago Natural History Museum.	1951 ± 200
137	*Hopewell Shell*: Same as 136 except material is conch shells. Sample Nos. 56,358 and 56,605. Submitted by G. Quimby. Comment: Agrees with charcoal (136).	2285 ± 210
139	*Hopewell I*: Same as 136 and 137 except material is bark. Sample No. 56,094. Comment: Agrees with charcoal and shell (136, 137).	2044 ± 250
152	*Hopewell II*: Wood from Hopewell mound 9 at Havana, Illinois. Submitted by Thorne Deuell, Illinois State Museum. Comment: Seems to check with Ohio Hopewell.	2336 ± 250
465	*Goldthwaite*: Large log from the Tazewell or Cary drift near Oxford, Ohio, Hamilton, Ohio, Quadrangle, Oxford township, Section 26, just north of the creek. Submitted by R. P. Goldthwaite, Ohio State University.	At least 15,000 years
364	*Tolleston*: Wood from Tolleston level, Lake Chicago (may be Algonquin instead). Log found at base of lake sand overlying till in clay pit at Dalton, Illinois. Submitted by H. Bretz, Department of Geology, University of Chicago.	3469 ± 230
466	*Illinoian*: Wood found in till directly below Illinoian gumbotil in Vermillion Co., Illinois. Submitted by G. W. White, Department of Geology, University of Illinois.	Older than 17,000 years
535	*Tazewell*: Early Tazewell Shelbyville wood from Lake Kickapoo, Wedron, La Salle Co., Ill. This is supposed to be our only truly authentic Tazewell sample. Submitted by L. Horberg and H. Bretz, University of Chicago.	13842 ± 780
510	*Farmdale*: Wood from Farm Creek, Illinois, representing the earliest stages of the Wisconsin glaciation. Found 3′–4′ below the surface of the Farmdale loess. Submitted by Guy D. Smith, Bureau of Plant Industry, Beltsville, Maryland.	Older than 20,000 years
481	*Skunk Creek*: Wood found beneath presumably Mankato till on north bank of Skunk Creek, NE quarter, Section 15, T8ON, R22W, Polk Co., Iowa. Submitted by W. H. Scholtes, Iowa State College, Ames.	Older than 17,000

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
438	*Bridgeville*: Peat found beneath 17′ of alluvial deposit just west of Bridgeville, Pennsylvania. Thought to be Tazewell or Cary. Submitted by E. R. Eller, Carnegie Museum, Pittsburgh.	Older than 16,000
	D. West Virginia, North Carolina, and South Carolina	
336	*West Virginia Boreal*: Peat of pollen zone B (pine) from 12′3″ to 12′9″ in Cranberry Glades, West Virginia. Submitted by H. C. Darlington.	9423 ± 840
475	*Singletary Mankato*: Peat and lake sediments from Singletary Lake, North Carolina. The lake has three organic horizons. This sample is the second which has been tentatively identified from pollen as lying between the Mankato and Cary substages. Submitted by David G. Frey, University of North Carolina. Comment: Appears too old for Mankato.	Older than 20,000
476	*Singletary Cary*: Lowest of three layers in Singletary Lake. Submitted by David G. Frey.	Older than 20,000
363	*Santee*: Cypress wood from a large stump buried under 30′ of sand deposited by the Santee River in South Carolina. Stump was 11′ in diameter, larger than any now growing in the region. Submitted by Stephen Taber, University of South Carolina.	Older than 17,000
105	*Myrtle Beach*: Cypress wood from the Myrtle Beach area under the Pamlico Terrace. Submitted by Stephen Taber.	Older than 20,000
	E. Louisiana, Missouri, Mississippi, and Nebraska	
143	*Quimby IV*: Charcoal from secondary mantle of mound, Crooks Site, Marksville period mound (LA-3), in Louisiana. Submitted by G. Quimby, Chicago Natural History Museum.	1158 ± 250
150	*Quimby II*: Charcoal from top level of Tchefuncte site ST 2, Midden A, in Louisiana. Submitted by G. Quimby.	633 ± 150

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
151	*Quimby III*: Shell from top level of same Tchefuncte site as 150. Submitted by G. Quimby.	1233 ± 250
385	*Bonfils I*: Wood from the Bonfils sand terrace near the mouth of the Missouri River. This terrace is a remnant of the Festus Terrace, and the date therefore should apply to the Festus Terrace. Sample taken from 2′ above top of the gravel. Submitted by Louis C. Peltier, Washington University, St. Louis. Comment: Might be Mankato.	12148 ± 700
154	*Bynum II*: Bynum vegetal material from site MCs-16 in Mississippi. Submitted by John Cotter, National Park Service.	1276 ± 150
65	*Schultz I*: Charcoal from Medicine Creek Site Ft-50 in Nebraska. It is a mixture of soil bands A and B, which are 2′ apart. Submitted by C. B. Schultz, University of Nebraska.	5256 ± 350
108a	*Schultz III*: Charcoal from Soil B of above site.	8274 ± 500
470	*Schultz II*: Charcoal from Soil B at Ft-50, lower occupation zone feature 18, N 155/E 45. Collected later and more carefully, otherwise duplicate of 108a. Submitted by C. B. Schultz.	10493 ± 1500
471	*Lime Creek*: Lime Creek site charcoal, Ft-41, Frontier Co., Nebraska. Reference, p. 34, *Lime Creek Bulletin*. Submitted by C. B. Schultz.	9880 ± 670 9167 ± 600 Av. 9524 ± 450

F. Arizona, California, and New Mexico

162–174 *Bat Cave*: Corncobs and wood fragments from the debris in Bat Cave, New Mexico. The depth below the top correlates with the development of corn from a primitive form at the lowest layer of 6′ to essentially modern corn at the top. Excavated by Herbert Dick. Submitted by P. C. Mangelsdorf, Harvard.

Sample No.	*Layer (depth, ft)*	
167, cobs	0–1	1752 ± 250
173, wood	1–2	1907 ± 250
172, wood	2–3	2239 ± 250
164 + 171, corn and wood	3–4	2249 ± 250
170, wood	4–5	2862 ± 250

Comment: Lowest layer containing corn, of which there was insufficient material, would appear to be 3000–3500 years by extrapolation.

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
186	*California Archaic*: Charcoal from deepest levels of a San Francisco Bay shell mound. Submitted by R. F. Heizer.	633 ± 200 911 ± 180 Av. 720 ± 130
440 and 522	*California Early Horizon*: Charcoal from California Early Horizon Site SJo-68. Earliest recognized California culture. Submitted by R. F. Heizer.	4052 ± 160
216	*Cochise*: Charcoal bearing dirt from b^1 and b^2 beds shown in Fig. 13, p. 47, *The Cochise Culture*. This is the Sulphur Springs stage of the culture. Submitted by E. B. Sayles, Arizona State Museum, Tucson.	7756 ± 370
511	*Sulphur Springs*: Charcoal from Cochise Site No. 6 North, Sulphur Springs stage. Submitted by E. B. Sayles.	6210 ± 450
515	*Chiricahua*: Charcoal from Cochise Site No. 12, Chiricahua Stage. Submitted by E. B. Sayles.	4006 ± 270
556	*Antevs I*: Cochise charcoal found in wall of an arroyo tributary to main Wet Leggett arroyo in New Mexico. Depth, 9′8″ in beds which may be either Chiricahua or San Pedro. Collected and submitted by Ernst Antevs. Comment: Apparently this is Chiricahua.	4508 ± 680
519	*San Pedro*: Charcoal from Cochise Site No. 3, San Pedro stage. Submitted by E. B. Sayles. Comment: Samples 511, 515, and 519 show the expected age sequence.	2463 ± 310
377	*Folsom*: Charcoal from Folsom type site by H. J. Cook, Agate, Nebraska. Charcoal sample from hearth in secondary channel of later date than bison and artifact deposit.	4575 ± 300 3923 ± 400 Av. 4283 ± 250

G. Nevada and Oregon

221	*Gypsum Cave*: Dung of giant sloth from Gypsum Cave, Las Vegas, Nevada. Collected by M. R. Harrington in 1931 from Room 1, dung layer 6′4″ from surface. Submitted by M. R. Harrington via Ruth Simpson, Southwest Museum, Los Angeles.	10902 ± 440 10075 ± 550 Av. 10455 ± 340
222	*Gypsum Cave*: Same from small room southwest of room 1. Taken	8692 ± 500 8051 ± 450

Our No.	Sample	Age (years)
	2′6″ from surface.	8838 ± 430 Av. 8527 ± 250
281	*Leonard Rock*: Unburned guano from layer containing wooden artifacts in Leonard Rock shelter, Nevada (LRS2). Submitted by R. F. Heizer, University of California, Berkeley.	8443 ± 510 8820 ± 400 Av. 8660 ± 300
298	*Leonard Rock II*: Atlatl foreshafts of hardwood (*sarcobatus*, greasewood) from layer described in 281. Submitted by R. F. Heizer.	7038 ± 350
554	*Leonard Rock III*: Carbonized basketry from upper guano layer, Area C. Associated with infant burial. Submitted by R. F. Heizer.	2736 ± 500
277	*Lovelock I*: Burned guano from pre-occupation level, Lovelock Cave, Nevada. (LC4A.) Submitted by R. F. Heizer.	4448 ± 250
278	*Lovelock II*: Unburned guano, pre-occupation level, Lovelock Cave. (LC4B.) Submitted by R. F. Heizer.	6046 ± 300 5961 ± 400 Av. 6004 ± 250
247	*Mazama*: Charcoal from a tree killed by the eruption of Mount Mazama in eastern Oregon (this formed Crater Lake). Submitted by L. S. Cressman, University of Oregon.	6389 ± 320 7318 ± 350 5938 ± 400 6327 ± 400 Av. 6453 ± 250
428	*Sandals*: Several pairs of woven rope sandals found in Fort Rock Cave, covered by the Newberry eruption in Oregon. Submitted by L. S. Cressman. Comment: Oldest artifacts measured in the Americas.	9188 ± 480 8916 ± 540 Av. 9053 ± 350
430	*Catlow Cave*: Organic debris from Catlow Cave No. 1 in Oregon. Taken from 2.88′ depth (No. 1–3025). Submitted by L. S. Cressman.	1118 ± 190 798 ± 230 Av. 959 ± 150
	H. Minnesota, Wisconsin, and Wyoming	
496	*Bronson Interglacial*: Wood from a well, Bronson Station No. 1, 88′ below surface in association with a wealth of plant material in a preglacial spruce-tamarack forest. Collected by C. O. Rosendahl, Department of Botany, University of Minnesota; (*cf. Ecology*, 29, 291–6 [1948]). Submitted by W. S. Cooper, University of Minnesota. Comment: Older than 497.	Older than 19,000
497	*Moorhead Interglacial*: Wood from Moorhead Station No. 2, Minnesota, late Pleistocene. May be associated with early history of Lake Agassiz; (*cf. Ecology*, 29, 289–90 [1948]). Collected by C. O. Rosendahl and submitted by W. S. Cooper. Comment: Appears to be contemporaneous with Two Creeks Mankato.	11283 ± 700
454	*Angostura*: Charcoal from Angostura Reservoir, South Dakota; horizontal zone 3.5″ thick mixed with clay (decomposed Pierre Shale). Sample No. 39FA65–203 from Square N7E4, Area B. Submitted by F. H. H. Roberts. Comment: Looks like Yuma or Cochise.	7715 ± 740
334	*Boreal III*: Peat from Jackson Camp, Minnesota. Taken from 8′ depth in Pollen Zone B (Pine period) by J. E. Potzger, Butler University, Indianapolis, Indiana. Submitted by E. S. Deevey, Jr., Yale.	7586 ± 490 6866 ± 350 Av. 7128 ± 300
332	*Minnesota Boreal*: Peat from 8.5 m depth in Cedar Bog Lake, Minnesota. Pollen zone B. Collected by M. Buell. Submitted by E. S. Deevey, Jr.	7988 ± 420
308 365 366 536 537	*Two Creeks*: Wood and peat samples from Two Creeks Forest Bed, Manitowoc Co., Wisconsin. Forest Bed underlies the Valder's Drift (Thwaites). Apparently the spruce forest was submerged, pushed over, and buried under glacial drift by the last advancing ice sheet in this region. Thought to be Mankato in age.	
	Sample — *Collection*	
	308 (Sprucewood) — L. R. Wilson, University of Massachusetts	10877 ± 740
	365 (Tree root) — J. H. Bretz, University of Chicago	11437 ± 770
	366 (Peat in which root [365] was rooted) — University of Chicago	11097 ± 600
	536 (Sprucewood) — J. H. Bretz and L. Horberg, University of Chicago. Collected several	12168 ± 1500

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
	years later than 308, 365, and 366 in 1950.	
537 (Peat)	(Same as above)	11442 ± 640 Av. 11404 ± 350
	Comment: Agreement among samples seems satisfactory.	
504	*Sand Island*: Peat from Sand Island, Bayfield Co., Wisconsin. This unique peat dates the one-outlet stage of the Nipissing Great Lakes. Submitted by L. R. Wilson.	3656 ± 640
419	*Lake Butte*: Glacial wood (*cf. Bull. Geol. Soc. Am.*, 54, 136 [1943]) found between Appleton and Menasha, Wisconsin, on the eastern short of Little Lake Butte des Morts. Log protruded from a sloping bank of varved clay, perhaps reworked but older than the surface till of Valder's Drift. Appears flattened by pressure. Collected and submitted by F. T. Thwaites, University of Wisconsin, Madison. Comment: Looks young.	5938 ± 300 6864 ± 300 Av. 6401 ± 230
302	*Yuma*: Partially burned bison bone with high organic content, from Sage Creek, Wyoming, Yuma site of Eisely and Jepsen. Submitted by G. L. Jepsen, Department of Geology, Princeton University.	6619 ± 350 7132 ± 350 Av. 6876 ± 250
	I. Alaska	
101	*Johnson I*: Charcoal and charred	1606 ± 180
102	wood samples from frozen arti-	1460 ± 180
112	fact layer in the Yukon. Submitted by F. Johnson, Phillips Academy, Andover, Massachusetts.	Av. 1519 ± 150
260	*Ipiutak*: Wood from the Ipiutak culture deposit at Deering, Seward Peninsula, Alaska. Third level. Estimated date A.D. 0–500. Excavated by Helge Larsen, summer of 1949. Submitted by F. Rainey, University Museum, Philadelphia.	973 ± 170
266	*Ipiutak II*: Wood from grave 51 at Ipiutak as described in "Ipiutak and the Arctic Whale Hunting Culture." Larsen and Rainey, *Arch. Papers Am. Mus. Nat. Hist.*, 42. Submitted by Helge Larsen, University of Alaska. Comment:	912 ± 170

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
	Seems to agree with other Ipiutak sample (260).	
409	*Aleut I*: Charcoal from an Aleut village site near Nikolski on Unimak Island. This particular sample was taken from a depth of 433 cm and is pre-Aleut in age. Submitted by W. F. Laughlin, University of Oregon.	2920 ± 240 3407 ± 520 Av. 3018 ± 230
299	*Fairbanks*: Wood found under 80–100 feet of frozen muck in the gold diggings near Eva Creek, Fairbanks, Alaska. Submitted by Wendell Oswalt, University of Alaska Museum.	Older than 20,000
506	*Alaska II*: Charred wood from middle levels, Iyatayet site, Norton Bay, Alaska. Excavated by Giddings, 1949. Submitted by Froelich Rainey, University of Pennsylvania Museum.	1460 ± 200
	IV. Mexico	
	(Principal collaborator: H. de Terra.)	
199	*Mexico I*: Charcoal from Tlatilco, early to middle Archaic. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla, Museo Nacional de Antropologia, Mexico, D. F.	3407 ± 250
196	*Mexico II*: Charcoal from Zacatenco I, early Archaic. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla.	3310 ± 250
203	*Mexico III*: Charcoal from the core filling of the Pyramid of the Sun, Teotihuacán I. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla. Comment: Looks as though sample is inhomogeneous.	2434 ± 500 1519 ± 200 Av. Heterogeneous
198	*Mexico IV*: Charcoal from preceramic level at Tlatilco. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla.	6904 ± 450 6017 ± 320 Av. 6390 ± 300
200	*Cuicuilco*: Charcoal from pottery level below lava. Late Archaic. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla.	2422 ± 250
202	*Loma*: Charcoal from Loma del Tepalcate. Late Archaic. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla.	2565 ± 200
207	*Pueblito*: Charcoal from preceramic level of MacNeish in rock shelter of Sierra de Tamaipais, northeast Mexico. Site 174,	505 ± 165 990 ± 220

Our No.	Sample	Age (years)
	Square N25, La Perra or Pueblito culture. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla. Comment: Much too young.	Av. 651 ± 150
204	*Becerra Wood*: Wood from Ciudad de los Deportes (Mexico City), Armenta Horizon, associated with mammoth, horse, etc. Younger Becerra formation. Collected by H. de Terra. Submitted by D. F. R. de la Borbolla.	Older than 16,000
205	*Becerra Peat*: Peat from same station as 204 but 500 m east. Also from the Armenta Horizon. Collected by H. de Terra. Submitted by D. F. R. de la Barbolla.	11003 ± 500
421	*Tepexpan I*: Stems and roots of aquatic plants 48″–70″ down at the fossil man site, Tepexpan, El Risco Horizon. Collected and submitted by H. de Terra. Comment: Younger than expected.	3800 ± 450 4430 ± 350 Av. 4118 ± 300
422	*Sun Temple*: Charcoal from Atetelco, Teotihuacán. Taken from floor of temple south of the painted patio. Collected and submitted by H. de Terra.	1878 ± 200 2611 ± 330 Av. 2244 ± 180
423	*Sun Temple*: Wood from large pillar on exhibit at Teotihuacán, originally in temple of Quetzalcoatl Nuevo (younger temple) in the "*Ciudadella*" of Teotihuacán. Submitted by H. de Terra. Comment: Much too old.	3424 ± 230
424	*Alban I*: Charcoal from Monte Negro, Temple X, Tilantongo, Oaxaca. Monte Alban I level. Submitted by Alfonso Caso.	2518 ± 250 2680 ± 200 Av. 2600 ± 170
425	*Monte Alban II*: Clean charcoal from Monte Alban, IIa level. Submitted by Alfonso Caso.	2223 ± 145
426	*Alban III*: Wood from tomb of Chochapan, Monte Alban III level. Submitted by Alfonso Caso. Comment: This date needs checking because of experimental difficulties in the measurement.	1652 ± 185
	F. South America (Principal collaborator: J. B. Bird.)	
75	*Peruvian*: Algaroba wood from roof beam section of subterranean house found in Huaca Prieta No. 5, at the level of first appearance of maize and Cupisnique pottery, Chicama Valley, Peru. Collected and submitted by J. B. Bird, American Museum of Natural History, New York.	2665 ± 200
271	*Paracas*: Cotton cloth from the mummy brought to New York in 1949 by Rebecca Carrion, National Museum of Anthropology and Archaeology, Peru. From Paracas Necropolis. Submitted by J. B. Bird.	2190 ± 350 2336 ± 300 Av. 2257 ± 200
316–322	*Chicama*: A series of samples from Huaca Prieta Mound No. 3. Collected and submitted by J. B. Bird.	
	Sample No. — *Level (depth in ft from top)*	
	321 (12) (plant material) — HP3-D, 6	2966 ± 300
	318 (9) (wood) — HP3-J2, 22	3550 ± 600
	316 (7) (wood) — HP3-M, 30	4380 ± 270
	315 (6) (shell) — HP3-M, 30	3572 ± 220
	313 (4) (wood) — HP3-Q1, 36	4257 ± 250
	Comment: Sample 318, first run, looks incorrect.	
322	*Chicama IV*: Wooden digging stick from House No. 7 of Huaca Prieta Mound No. 5. Should be more than 100 years older than Cupisnique (75). Submitted by J. B. Bird. Comment: Checks satisfactorily.	3278 ± 250 3333 ± 340 Av. 3310 ± 200
460	*Nazca I*: Wooden shafts of Atlatl darts banded with black pigment, Nazca A period; Section Aj, Location A, Grave 10. Cahuachi, Valley of Nazca, Peru. Should be roughly contemporaneous with Paracas mummy. Collected by A. L. Kroeber, University of California, Berkeley, and submitted by D. Collier, Chicago Natural History Museum. Comment: Too young.	1314 ± 250
521	*Nazca II*: Wood fragments of Atlatl shaft from Grave 12, Location A, Section Aj, Cahuachi, Valley of Nazca. Nazca A period. Catalogue numbers: 171,245; 171,246. Should be contemporaneous with Paracas mummy. Collected by A. L. Kroeber and submitted by D. Collier.	1681 ± 250 2477 ± 200 Av. 2211 ± 200
	Grand average, including 460	1988 ± 200
	Comment: Agrees better.	

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
484	*Chilean Sloth*: Dung of giant sloth from Mylodon Cave, Ultima Esperanza, Chile (51°35′S). Not associated with human artifacts, though sloth and man found together in three caves 125 miles distant (*cf.* sample 485). There is an as yet undetermined correlation with the last ice advance in Patagonia. Submitted by J. B. Bird. Comment: Looks like Gypsum Cave, Two Creeks.	10800 ± 570 10864 ± 720 Av. 10832 ± 400
485	*Chilean Bone*: Burned bone of sloth, horse, and guanaco, associated with human bones and artifacts. Valuable in determining time of arrival of man at tip of South America. Material found in Palliaike Cave, 125 miles east of Mylodon. Submitted by J. B. Bird. Comment: Most ancient of human samples from South America. Contemporaneous with Gypsum Cave, etc.	8639 ± 450
378	*Chincha*: Guano from North Chincha Island found beneath 3′6″ of windborne sand at Quebrada del Panteon by G. Kubler, Department of History of Art, Yale. Submitted by G. Kubler. Comment: Very ancient.	Older than 19,000

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
382	*Moche*: Ash mixed with bone from Moche site at Huaca del Sol, northern Peru. Taken from habitation site, ground level, beneath pyramid on north face in center. Collected by G. Kubler.	2823 ± 500
	VI. Tree Ring Samples	
103	*Tree Ring*: Douglas fir wood excavated by Morris in 1931 from Red Rock Valley, Room 6, Broken Flute Cave. Inner ring, A.D. 530; outer ring, A.D. 623. Submitted by T. L. Smiley, Laboratory of Tree Ring Analysis, University of Arizona, Tucson. Comment: Looks low *vs.* expected 1370.	973 ± 200 1070 ± 100 Av. 1042 ± 80
159	*Sequoia*: Wood from the heart of the giant redwood known as the "Centennial Stump," felled in 1874 with 2905 rings between the innermost (and 2802 rings between the outermost) portion of the sample and the outside of the tree. Therefore known mean age was 2928 ± 51 years. Submitted by E. Schulman, Laboratory for Tree-Ring Research, University of Arizona, Tucson. Comment: Agreement satisfactory. Apparently sap and heartwood do not exchange.	3045 ± 210 2817 ± 240 2404 ± 210 Av. 2710 ± 130

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Technical Papers

Clotting Time and Reaction Velocity in the Interaction of Bovine Fibrinogen and Thrombin

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The clotting time and coagulation time end points of different techniques vary. The first appearance of compactible fibrin in an agitated solution (*1, 2*), the formation of a visible fibrin web in a quiescent solution (*3*), or the formation of a gel sufficiently rigid to resist deformation on tilting (*4–6*), has been used. Clotting times (*7, 8*) have been employed to characterize the development of gel structure, to compare clinically important agents, and frequently to establish the level of activity in an unknown solution. In the latter case, the unknown concentration is adjusted to the point where, when a small volume is added to a solution containing other components in reproducible concentration, pH, etc., the end point is obtained in a stated period of time. The necessity of controlling adequately all known variables has been emphasized (*2, 9*). The assumption has been made (*10*) that clotting time is related inversely to the reaction velocity.

It has been our experience that the quantity of fibrin and potential fibrin[1] necessary to establish a clotting time based on the first appearance of fibrin strands, or to cause a solution to gel, is a function of the fibrinogen and thrombin concentrations, the pH, ionic strength, etc., and that this quantity may be altered by the addition of materials such as gum acacia, phenol, formaldehyde, urea, or glycerol. A quantitative relationship between even a limited number of pertinent variables is of importance in understanding the way in which clot structure is developed, and will be of eventual use in interpreting clinical and other data.

In previous work (*11*), the interaction of fibrinogen and thrombin at pH 6.85, added ionic strength 0.15 (0.05 phosphate and 0.1 sodium chloride), and 22.7° C was studied over the ranges 0.009–0.45 N.I.H. units per ml thrombin and 0.036–0.35 mg clottable nitrogen (C.N.) per ml. The fibrinogen and thrombin preparations were those of Armour & Co.[2] In the following, Th_o and ϕ_o are the total thrombin and initial fibrinogen concentrations in the above units.

A typical reaction curve, which measures the amount of fibrinogen, activated fibrinogen, and noncompactible fibrin remaining in solution after compactible materials have been removed, is shown in Fig. 1, curve 1. In this reaction $\phi_o = 0.18$, and $Th_o = 0.045$. $\theta = \phi/\phi_o$ represents the fraction of total clottable nitrogen remaining in solution at time t in min. In plotting $ln\ 1/\theta$ vs. t, a pseudo first-order reaction is assumed. Beyond 5.5 min a linear plot is obtained, the extrapolation of which passes through the origin. The difference between corresponding points on the nonlinear portion and linear extrapolation represents the accumulation of activated fibrinogen and noncompactible fibrin. Linearity is established when sufficient compactible fibrin is present to keep these components at negligible values. Thus, the linear portion and linear extrapolation may be considered to represent the formation of activated fibrinogen whatever its physical state. Fig. 1, curve 2, represents the same reaction run in the presence of 1.54% purified gum acacia (for the effects of which see [*1*]) and shows that the main effect of acacia is to promote compaction and reduce the nonlinear events, a minor effect being an increase in reaction velocity.

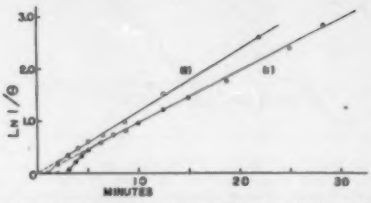

FIG. 1. Typical reaction curves for $\phi_o = 0.18$ mg C.N./ml and $Th_o = 0.045$ N.I.H. μ thrombin/ml (curve 1). Curve 2 represents the same reaction run in the presence of 1.54% purified gum acacia.

The linear portions of the reactions examined conform to the equation:

$$ln\frac{\phi_o}{\phi} = \frac{0.482\ Th_o}{0.051 + \phi_o}t. \qquad (1)$$

The most reasonable interpretation of equation (1) is that thrombin combines mainly in an equal, reversible, inactive complex with fibrinogen and fibrin, the life of any assumed active complex being short compared to the diffusion time between fruitful collisions.

Clotting times, using 1.5 ml fibrinogen solution in a tube of 1.0 cm I.D., 0.15 ml thrombin, and taking the first traces of visible fibrin in the gently agitated tube as an end point (as in [*2*]), have been determined for essentially the same ranges of Th_o and ϕ_o as for the kinetic studies. To give comparable data, acacia was not present. The fibrin and potential fibrin, $\phi' = \phi_o - \phi$, present at a given clotting time, T_c, may be calculated by equation (1). When ϕ' is plotted vs. ϕ_o, Fig. 2, a series of lines is obtained having a common intercept at $\phi_o = -0.11$ and slopes given by

[1] Clotted material which can be separated easily after compaction will be termed fibrin. The sum of activated fibrinogen and noncompactible fibrin (i.e., fibrin particles not yet incorporated into the compactible structure) will be termed potential fibrin.

[2] We are greatly indebted to the Chemical Research and Development Department of Armour & Co., Chicago, Ill., for supplying these materials and for generous financial support.

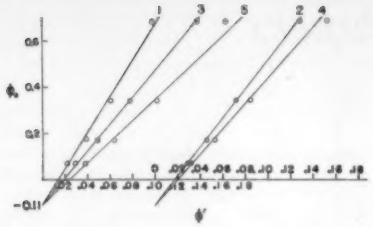

FIG. 2. Potential fibrin, ϕ', plotted as a function of the initial fibrinogen concentration, ϕ_o, both in mg C.N./ml. The curves and corresponding thrombin concentrations, in N.I.H. units/ml, are (1), 0.045; (2), 0.091; (3), 0.136; (4), 0.227; and (5), 0.454. Lower values on the abscissa refer to curves (1), (3), and (5).

$(3.8 - Ln\ \mathrm{Th}_o)$. The lines of Fig. 2 were drawn according to the final equation, which is:

$$\phi' = \frac{\phi_o - 0.11}{3.8 - Ln\ \mathrm{Th}_o}. \qquad (2)$$

On combination, equations (1) and (2) yield:

$$T_c = \frac{0.051 + \phi_o}{0.482\ \mathrm{Th}_o} Ln \frac{\phi_o\ (3.8 - Ln\ \mathrm{Th}_o)}{\phi_o\ (2.8 - Ln\ \mathrm{Th}_o) - 0.11}. \qquad (3)$$

Equation (3) should describe the clotting times obtained when Th_o and ϕ_o are varied. The lines shown in Figs. 3 and 4 were calculated by equation (3), the experimental points, averages of several determinations, being shown. In view of the subjective nature of clotting time measurements, the agreement is satisfactory.

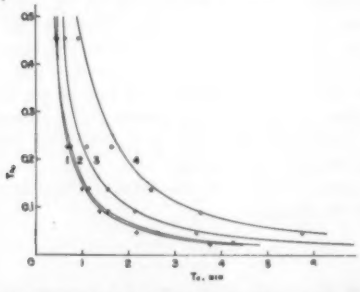

FIG. 3. Clotting time in min as a function of thrombin concentration in N.I.H. units/ml of final solution. The curves and initial fibrinogen concentrations in mg C.N./ml are: (1), 0.07; (2), 0.17; (3), 0.345; and (4), 0.68.

Equation (3) predicts, as has been found (*4, 6, 10, 12*), that clotting times will decrease with decreasing ϕ_o until a critical value is reached, after which they will increase. $T_c = \infty$ is obtained when $\phi_o = \infty$ and when $\phi_o\ (2.8 - Ln\ \mathrm{Th}_o) = 0.11$, in theory for the latter case when the establishment of clotting time requires as potential fibrin all the fibrinogen in solution. These values for several values of Th_o are recorded in column 2 of Table 1. Columns 3 and 4 record the minima in T_c and corresponding values of ϕ_o, obtained in the usual way by differentiating equation (3). The ϕ_o value for min. T_c, corresponding to about 0.1% fibrinogen at

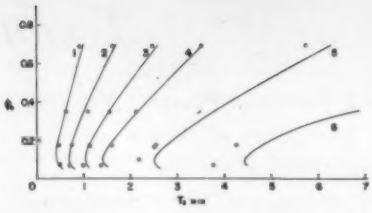

FIG. 4. Clotting time in min as a function of the initial fibrinogen concentration in mg C.N./ml. The curves and corresponding thrombin concentrations in N.I.H. units/ml are: (1), 0.454; (2), 0.227; (3), 0.136; (4), 0.09; (5), 0.045; and (6), 0.023.

$\mathrm{Th}_o = 0.5$, is in accord with similar values reported in the literature (*4, 6, 10, 12*).

The first traces of retractable fibrin are established differently for ϕ_o values above and below the T_c minimum in the $\phi_o - T_c$ curves. Thus the end points are qualitatively different. For ϕ_o values above the minimum, visible fibrin strand formation appears to be

TABLE 1

Th_o	Calculated	Calculated minima	
	ϕ_o at $T_c = \infty$	T_c	ϕ_o
0.022	0.016	4.6	0.092
.045	.019	2.5	.095
.091	.021	1.4	.097
.136	.023	1.0	.10
.227	.026	0.69	.102
0.454	0.031	0.42	0.107

an average property of the solution, a slight turbidity being observed throughout just before strand formation, which also takes place throughout the solution. At ϕ_o values below the minimum, different types of behavior have been observed, two of which seem to depend on the recruitment of fibrin from the entire solution, and a third on the appearance of fine flocculates instead of strands. At $\mathrm{Th}_o = 0.14$ and ϕ_o values between 0.07 and 0.04, a few strands are formed suddenly at the end point; between $\phi_o = 0.03$ and 0.01, a fine flocculation appears; and below $\phi_o = 0.01$, the solution remains clear until, on disturbance, a minute amount of compactible fibrin is observed. Thus, using the end point described, "clotting times" may be observed at $\phi_o = 0.001$ or less, depending in part on the volume of solution in which the test is conducted. T_c assumes a relatively constant value, approximately equal to the minimum for T_c in the calculated $\phi_o - T_c$ curves, for ϕ_o values between the minimum and that at which an infinite clotting time would be calculated, after which T_c increases rapidly. Likewise at values of ϕ_o below the calculated minimum, sol-gel end points, of a subjective nature, are equally difficult or impossible to establish. This fact has led to the acceptance of different end points for different regions of the $\phi_o - T_g$ curves (*6*).

Since clotting time is established when the first

traces of compactible fibrin are visible, a correlation should be observed between T_c and the time when the corresponding reaction curve leaves the $ln\ 1/\theta$ axis (Fig. 1), at which time the first traces of compactible fibrin are determined experimentally. Deviations from the abscissa, calculated clotting times, and observed clotting times are recorded for a number of reactions in columns 3, 4, and 5 of Table 2, the first two columns defining ϕ_o and Th_o. Close agreement is observed.

The last column of Table 2 records values of ϕ' calculated by equation (2). The initial velocity of the fibrinogen-thrombin reaction is given by the differential form of equation (1), using $\phi = \phi_o$, or

$$-\frac{d\phi_o}{dt} = \frac{0.482\ Th_o}{0.051 + \phi_o}\phi_o. \qquad (4)$$

The rate of formation of activated fibrinogen increases with increasing Th_o and ϕ_o. In all cases, ϕ' increases with increasing rate (equation [2]). This is not unexpected, for, as the reaction velocity increases, more potential fibrin will appear before the retractable clot structure is developed. At constant ϕ_o, clotting times

TABLE 2

ϕ_o	Th_o	First deviation from $ln\ \frac{1}{\theta} = 0$ (min)	Calculated T_c (min)	Observed T_c (min)	Calculated ϕ'
0.185	0.009	9.5	10.7	____	0.035
"	.023	4.5	4.89	4.26*	.039
"	.045	2.5	2.69	2.5*	.043
"	.068	1.6	1.83	1.6*	.046
"	.091	1.3	1.54	1.24*	.048
"	.227	0.50	0.74	0.75*	.056
"	0.454	0.25	0.47	0.47*	0.064
0.035	0.045	1.3	1.8	____	0.021
.075	"	1.3	2.0	2.18	.028
.11	"	1.8	2.2	____	.032
.185	"	2.5	2.6	2.69	.043
0.35	"	.....	3.5	3.46	0.067

* For $\phi_o = 0.172$.

decrease with increasing reaction velocity (increasing Th_o), suggesting that the less effective utilization of potential fibrin at the higher rates is more than balanced by the rate of appearance of activated fibrinogen. At constant Th_o, and increasing ϕ_o, the opposite appears to be the case; the decreased utilization of potential fibrin overbalances the increased rate of activated fibrinogen appearance, and the clotting time increases with increasing reaction velocity. As a partial explanation for the latter phenomenon, it is suggested that the cross-linking of fibrin strands, or incorporation of potential fibrin into the compactible structure, is suppressed by increasing concentrations of residual fibrinogen. A relationship between rate and ϕ' may be obtained from equations (2) and (4). It is probable that the change in end point observed when ϕ_o decreases below the minimum value, and the

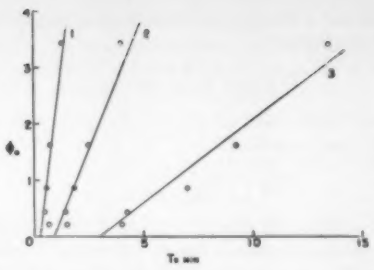

FIG. 5. Sol-gel transformation times in min as a function of fibrinogen concentration (mg C.N./ml) obtained from the data of Ferry and Morrison (4). The curves and corresponding thrombin concentrations are: (1), 4.0; (2), 1.0; and (3), 0.2.

fact that T_c remains relatively constant over a large range in ϕ_o, may likewise be associated with the above effect of fibrinogen.

Clotting times are all considerably smaller than those required to establish linearity. Thus, for the reaction of Fig. 1, curve 1, linearity occurs at 5.5 min, whereas the clotting time occurs at 2.7 min. A comparison of corresponding points on the reaction curve and the extrapolated linear portion at 2.7 min shows that the major portion of ϕ' is not in a compactible form. This is to be expected. On a relative basis, to keep the concentration of activated fibrinogen and fibrin particles negligible, the retractable clot structure must be extensive, the distances between fibrin strands small, and the aggregating area (surface area) of the fibrils large. As a first approximation, the compactible clot may be visualized as strands running along the edges of closely packed tetrahedra. Were the strands to maintain a constant axial ratio, the quantity of fibrin would be independent of the coarseness or fineness of the clot and dependent only on the axial ratio. The variations in ϕ' with ϕ_o and Th_o expressed by equation (2) and illustrated in Fig. 2 and Table 2, in addition to the presence of potential fibrin, may be due to a progressive change in axial ratio (length of tetrahedron edge over fiber diameter) which, if it were operating alone, would of necessity increase as the length of the fiber increased; i.e., the axial ratio in a fine clot would be smaller than that in a coarse clot. Regions of the reaction curves near the point where deviations from the abscissa occur will be examined in detail to determine the relative contributions from nonutilization of potential fibrin and average change in axial ratio (or some similar property of the compactible clot).

Sol-gel transformation times in the above experiments are somewhat longer than clotting times, but lie also on the nonlinear portions of the reaction curves, and will conform to an equation similar to (3). That such is the case in another system may be observed from Fig. 5, which has been calculated from the data of Ferry and Morrison (4) obtained with human fibrinogen and thrombin at pH's near 6.8 and ionic

strength 0.3. The points represented conform to the empirical equation:

$$T_g = \frac{\phi_o + 0.9}{0.76\ \mathrm{Th}_o + 0.16}. \qquad (5)$$

Similarly, the curves of Fig. 4 may be expressed by the empirical equation:

$$T_c = \frac{\phi_o + 0.3}{2.66\ \mathrm{Th}_o + 0.05}. \qquad (6)$$

Both equations are useful only at ϕ_o concentrations above the T minimum in the $\phi_o - T$ curves. Equations (5) and (6) indicate a similar basis of measurement in the two systems.

The presence of 1.53% acacia (Fig. 1) increases the reaction velocity by about 20%. On the basis of clotting time measurements the "reaction" has been accelerated by a factor of about 1.8, since acacia has decreased the clotting time from 2.5 to 1.4 min. The major portion of the effect, as indicated above, is due to a shift in the distribution of fibrin and potential fibrin. Thus, accelerators or inhibitors might not affect the rate of a reaction appreciably, but might cause large changes in clotting time by altering the distribution between fibrin and potential fibrin, and by changing the absolute value of the former. For this reason, the use of clotting times alone to compare reaction velocities at different pH's and ionic strengths or in the presence of accelerators or inhibitors is open to question.

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Radiocarbon Age Measurements and Fossil Man in Mexico

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The final release of radiocarbon dates obtained by Arnold and Libby (*1*) includes a number of age determinations of plant materials from prehistoric sites in the basin of Mexico that I collected for that purpose. Considering the geographic location of these localities, intermediate between North and South American prehistoric stations, a brief commentary is warranted, with special reference to the geologic antiquity of man in that region. Basic for this problem are the two age measurements (*1*, p. 13, samples No. 204 and No. 205) for two samples, wood and peat, from the Becerra formation, which represents the Upper Pleistocene in that area. The time range indicated is 10,603–20,000 years ago, the latter date referring to results previously communicated to me. It happens that the peat sample was collected by my Mexican collaborator, A. R. V. Arellano, from a geological horizon and level that corresponds in topographic elevation and stratigraphic position with the swamp deposit at Tepexpan where I had found the partly fossilized remains of "Tepexpan Man." At both localities fossil bones of elephant and horse occur, a tooth of the latter having been found in a later excavation 5 yards distant from the original position of the human bones. As the new excavation trench substantiated the impression of an undisturbed occurrence of human remains with fossil elephant, the date for the Becerra peat being 11,300 ± 500 years ago, my original estimate of 11,000–12,000 years for the human bones appears to be supported by the radiocarbon count.

A special effort was made last year to secure plant samples from the Tepexpan Man site itself, a task which involved the removal of some 4 tons of clay, from which delicate plant roots were extracted. Although it was by no means certain that these roots and stems had not grown from a younger lake floor into deeper and older sediments, such an effort nevertheless promised information on their mode of origin and age. A botanical examination of the roots was made by J. Beal, head of the Botany Department, University of Chicago, who believes that they belonged to an unidentifiable water plant, uncarbonized and in a fresh state of preservation. At the site, single roots were seen to extend 10–12 in. into laminated sandy clay of buff coloring, the roots standing upright and fading out toward the overlying caliche soil (4 in.). The latter showed faint traces of dark root canals that must have extended from the overlying marsh deposit, a sandy marl 15 in. thick, from which fresh-water shells and roots had previously been reported (*2*, p. 38). Considering the nature of the sediment below the caliche, a laminated deposit requiring a slow rate of sedimentation, it is most unlikely that roots could have grown at the same rate as deposition of sediment proceeded. The fresh preservation is obviously due to the sealing effect of the overlying caliche, which prevented bacterial action at a depth of 30–40 in. below the marl. Some modern water plants in the relic Lake Texcoco, in the basin of Mexico, showed roots and stems 10–20 in. long, a length that might well have been exceeded at Tepexpan in view of the waterlogged condition of the older swamp deposit below the caliche.

In the light of these considerations, the age measure-

ment (*1*, p. 13, sample No. 421) for the Tepexpan roots, 4,118 ± 300 years, indicates the date for the younger marl above the caliche, not for the bone-bearing layer itself. In other words, paleontologists and prehistorians need not infer from this radiocarbon date that mammoth and horse existed that late in the basin of Mexico; on the contrary, the absence of such fossil remains in formations of Recent geologic age in that area clearly indicates their extinction long before that time.

Considering further that bone and stone artifacts have been found by me and others in the Becerra formation near Tequixquiac, on the northwestern margin of the basin of Mexico (*2*, pp. 46–49), human antiquity can in the light of these new radiocarbon dates be accepted as proved. In this respect, the age measurement of 6,390 ± 300 years for charcoal taken from a preceramic culture-level at Tlatilco affords a significant glimpse into Mexican prehistory, for it establishes an age of early human occupation that antedates the first appearance of organized farming societies of the Archaic civilization by about 3,000 years.

In all these studies much valuable cooperation was given me by my Mexican colleagues, notably Daniel F. R. de la Borbolla, Alfonso Caso, Engineer Arellano, and Arturo Romano. A monograph on the basin of Mexico, as well as a travel book of mine, will soon be published.

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Lipase from Molds Grown on Oil Seeds

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Camus (*1*), Garnier (*2*), and Wehmer (*3*) detected the presence of the enzyme lipase in molds like *Penicillium* and *Aspergillus* species. Ramakrishnan and Banerjee (*4*) found that the enzyme lipase obtained from the molds grown on oil seeds has a better activity than that obtained from the oil seeds.

In India, which stands second in the production of oil seeds, owing to improper storage and transport, millions of tons of oil seeds are spoiled every year because of mold growth. The authors have therefore undertaken a detailed study to analyze the different molds grown on different oil seeds, prepare the pure strains of the lipolytic molds from them, grow them in a synthetic medium, extract the lipase, and study its activity on various oils and fats.

In general the optimum pH for the lipases obtained from molds is 6.2. Disodium phosphate-citric acid is the best buffer, and ground-nut oil the best substrate.

Our preliminary survey has indicated that a cake medium is the best and cheapest for the production of lipolytic molds on a large scale. Work is under way to collect the strains of all the lipolytic molds, construct a pilot plant to grow them on a large scale, and extract lipase from them in a pure form.

Details of the results will be published elsewhere.

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In Vivo Transformation of D,l-3-Hydroxykynurenine in Xanthurenic Acid

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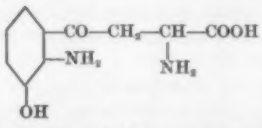
Musajo, Spada, and Casini (*1*) have recently accomplished the synthesis of D,l-3-hydroxykynurenine (small, citron-yellow crystals, mp 213° C, with decomposition):



This synthesis differs slightly from what appeared in a paper by Butenandt, Weidel, and Schlossberger (*2*) published shortly before the work of Musajo and collaborators; the German authors also mention the isolation of l-3-hydroxykynurenine from the fractionation of fresh chrysalids of *Calliphora erythrocefala.*

Musajo, Spada, and Casini have also shown (*1*) how 3-hydroxykynurenine can be transformed *in vitro* by heating with barium hydroxid in xanthurenic acid (4,8-dihydroxyquinoline-2-carboxylic acid) (*3*) and in 3-hydroxy-2-amino-acetophenone. From this transformation of 3-hydroxykynurenine we obtained about 30% by weight of xanthurenic acid.

Musajo and Chiancone determined in 1936 (*4*) that xanthurenic acid is formed *in vivo* from tryptophan through kynurenine. Later, in 1942, in the United States, Lepkovsky and Nielsen (*5*) brought to light the influence of vitamin B_6 on its formation.

Proceeding with our research on the genesis of xanthurenic acid, we treated rats with D,l-3-hydroxykynurenine and determined the xanthurenic acid eliminated with the urine. Parallel comparison experiments were also carried out with D,l-kynurenine. The animals were first held on a synthetic diet of casein, starch, fats, salts, and vitamins, and later gelatin was substituted for casein. From the urine of these animals, where xanthurenic acid was absent, after treating them

by mouth with D,l-3-hydroxykynurenine and D,l-kynurenine, we obtained results that can be summarized as follows:

1. The animals treated with a single dose of 50 mg of D,l-3-hydroxykynurenine eliminated with the urine in the following 48 hr 17–19.7% (calcd on the wt of 3-hydroxykynurenine employed) of xanthurenic acid.

2. The animals treated with 3 doses of 12.5 mg of 3-hydroxykynurenine (total, 37.5 mg in 24 hr) eliminated (in 48 hr) 20–28% of xanthurenic acid.

3. By administering 46.5 mg of D,l-kynurenine in a single dose (quantity corresponding to one of 3-hydroxykynurenine in the analogous experiments), an elimination of 2.5–4.2% (calcd on the wt of kynurenine) of xanthurenic acid was obtained.

4. With kynurenine divided into 3 doses of 11.6 mg each (total, 34.8 mg in 24 hr, quantity corresponding to one of the 3-hydroxykynurenine in the analogous experiments) an elimination of 9.1–11.2% of xanthurenic acid was obtained.

We therefore assume that xanthurenic acid is formed *in vivo* in the following manner:

Tryptophan→kynurenine→3-hydroxykynurenine→
→xanthurenic acid

The determinations of xanthurenic acid were made by a method which also takes into consideration the determination of the kynurenic acid studied by Musajo and Coppini.

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Depilatory Action of the Intermediary Polymers of Chloroprene[1]

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Temporary hair loss among workers engaged in the manufacture of neoprene rubber has been attributed to the inhalation of the volatile intermediary polymers of chloroprene, probably the cyclic dimers (*1, 2*). A single application of these compounds to the skin of animals produces complete local hair loss within 10 days, with disappearance of the follicles and sebaceous glands and excessive thickening of the epidermis. All these changes are reversible within 6 weeks.

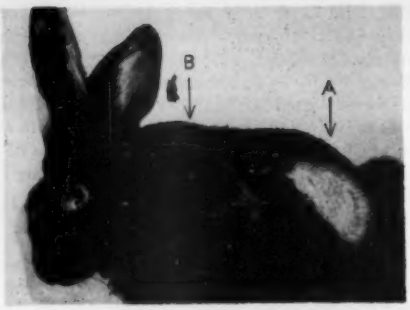

FIG. 1. *A*, hair loss in rabbit 10 days after application of a mixture of intermediary polymers of chloroprene; *B*, regrowth of hair in a patch treated 4 weeks earlier.

The depilatory agents were prepared as described by Ritter and Carter[3] (*1*). Local hair loss in rabbits, mice, and guinea pigs, and loss of feathers in chicks, were consistently obtained after a single application of 0.1–1 ml polymer mixture to the skin (Fig. 1). The localized temporary cessation of hair growth suggested interference with the normal process of keratinization, which involves the oxidation of –SH groups to –S–S– bridges. The intermediary polymers inactivated *in vitro* the free –SH groups of glutathione, human epidermis, and mouse liver homogenates, as determined by a previously described method (*3*). The concentrations necessary for this *in vitro* inactivation compared favorably with those required to induce baldness in animals. Inhibition of a sulfhydryl enzyme, succinic dehydrogenase (*4*), occurred with the same concentrations as inactivation of –SH groups (Fig. 2). The destruction of epidermal sulfhydryl groups was also demonstrated by histochemical methods (*5, 6*). This action of the chloroprene dimers differs from another reversible depilatory agent, thallium, which even in toxic concentrations has no effect on free –SH groups *in vitro* (*7*).

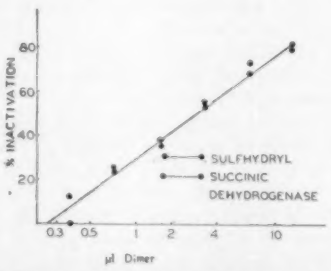

FIG. 2. Inhibition of free sulfhydryl groups and of succinic dehydrogenase activity in 10 mg mouse liver homogenate after 15 min incubation at room temperature with various concentrations of the depilatory agent.

[1] This work was done in part under a Damon Runyon Senior Clinical Fellowship of the American Cancer Society, Inc.

[2] We wish to acknowledge the helpful suggestions of Albert S. Carter, Jackson Laboratory, Du Pont Company, and of Wayne L. Ritter, Indianapolis, Ind.

[3] Chloroprene was obtained through the courtesy of E. I. du Pont de Nemours & Co.

The depilatory fractions of chloroprene polymers open new possibilities in the treatment of fungous infections of the scalp, in studies of hair growth and epidermal carcinogenesis (*8, 9*). The reversible transformation of the thin hairy animal epidermis into the thick hairless epidermis resembling human skin facilitates separation of the epidermis and its use for experimental purposes. Studies along these lines are in progress. Detailed data will be published elsewhere.

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Decomposition of Streptomycin[1]

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Some antibiotics are susceptible to decomposition (*1*). This is particularly the case with penicillin that is inactivated by many microorganisms through the enzyme penicillinase. Streptomycin is very resistant to decomposition, so much so that there is a prevailing opinion that it cannot be decomposed by microorganisms, although it is inactivated by such substances as H_2S, cysteine and certain other sulfhydryl compounds, and hydroxylamine (*2*). Nevertheless, the fact that it is a natural product gives reason to believe that it can be destroyed by microorganisms. The following studies with soils indicate that this is the case.

A method devised whereby streptomycin can be quantitatively determined in soil (*3, 4*) was used to trace the course of disappearance of the antibiotic. Streptomycin added to heat-sterilized soil at the rate of 1,000 μg/g of soil lost no activity in a period of three weeks, which was the extent of the test period. In unsterile soil more than half of the streptomycin activity had disappeared in one week and the loss was complete in two weeks. In soils receiving additions of glucose or glutamic acid, initial attack of the streptomycin was somewhat delayed. A second and third addition of streptomycin disappeared somewhat more rapidly than the first.

Soils that had been treated with streptomycin and also slime from a disposal system where waste from a streptomycin plant was treated, were inoculated into a mineral salts medium containing streptomycin as the only organic constituent. Bacteria developed in the medium and continued to grow in the same medium through serial transfers. Development was enhanced by continuous shaking during the incubation period. The crude cultures were plated on a nutrient agar medium containing 1,000 μg of streptomycin per ml. Various colonies were isolated from the plates and inoculated into the specific streptomycin medium. Several of the cultures grew and inactivated the streptomycin. The fact that the cultures were able to grow in the medium where streptomycin was the only organic constituent indicates that the streptomycin molecule must have been decomposed and that the inactivation was not due to some product of growth such as those mentioned above.

There was little or no loss of streptomycin from the solution medium supporting growth of crude and pure cultures for the first few days. In one week a significant amount of the activity was lost, and after 10–14 days all streptomycin activity had disappeared.

All the active bacterial cultures were alike according to the limited tests that have been made. The bacterium is a motile, nonsporulating, gram-negative rod producing a greenish-yellow pigment on nutrient agar. Litmus milk remained unaltered, and nitrate was not reduced. Gelatin was liquefied, but neither acid nor gas was produced from glucose, sucrose, or lactose. Although incompletely characterized, the bacterium is probably a member of the genus *Pseudomonas*.

It was characteristic of all substrates (soil, various solution media) and all cultures (soil, crude and pure cultures in solution media) that during decomposition of the streptomycin, volatile material having a characteristic pungent odor suggestive of malt and pyridine was liberated.

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[1] Journal Series Paper, New Jersey Agricultural Experiment Station, Rutgers University, The State University of New Jersey, Department of Microbiology.

Comments and Communications

Chemical Research in Israel

PROFESSOR LEOPOLD RUZICKA (*Science*, **112**, 126 [1950]) has based the evaluation of the organic chemical research carried out in a given country, not on the total number of publications per annum in the field of organic chemistry (Boig. *Science*, **110**, 107 [1949]), but on the ratio number of inhabitants: number of organic chemical papers published. I would like to be permitted to add to the interesting data so obtained the figures related to Israel, taking into account, of course, the great variation in the number of the Israeli population. The pertinent figures are:

For 1937: 36,000 (av. for the years 1935–39: 23,000)
For 1947: 33,000 (" " " " 1947–49: 37,000)

inhabitants for each organic-chemical publication.

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The Bible and the Earth's Shape

IN THE September 8, 1950, issue of SCIENCE W. A. Rockie tells of a "strong religious leader" who believes the world is flat. He didn't state the nature of this man's religion. As a fundamentalist Presbyterian and also as a member of the American Chemical Society's Committee on Scientific Aids for Literature Searching, I am much interested in locating early statements of scientific fact and seeing that the original source receives the proper credit.

The Bible itself nowhere states that the earth is flat. It does, however, have a number of passages concerning the shapes and conditions of the world, past, present, and future. I shall name but a few, giving scriptural texts:

1. At one time in its early history, the earth had no definite shape at all, either flat or round (Gen. 1: 2—"And the earth was without form, and void . . .").

2. The earth is suspended in an ethereal vacuum and is part of a universe of immeasurable size. Furthermore, any attempt to detect the presence of a supporting medium, such as the Michelson-Morley ether-drift experiment, will give a null answer (Job 26: 7—"He stretcheth out the north over the empty place, and hangeth the earth upon nothing"; Jer. 31: 37—"Thus saith the Lord; if heaven above can be measured, and the foundations of the earth searched out beneath, I will cast off all the seed of Israel for all they have done, saith the Lord").

3. A particularly striking picture is given by Job concerning the rotation of the earth. To understand it, one must be aware of the type of seals used by ancient peoples such as the Babylonians, Phoenicians, etc. These seals, perforated longitudinally and rotating upon a tiny axle of some hard material, were pressed against the face of the damp clay and rotated. As the seal was turned in the clay, it left its inscription. In like manner our earth is journeying on her annual orbital revolution. At the same time the planet is spinning on its axis, turning in the face of the sun like the seal in the face of the clay (Job 38: 14—"It is turned as clay to the seal; . . .").

4. The earth is round, not flat (Isaiah 40: 22—"It is he that sitteth upon the circle of the earth, . . ." Note: The word "circle" is a translation of a Hebrew word that literally means "roundness." The modern Swedish version uses the word *rund* which is a literal rendition of the idea of Isaiah).

5. The earth will be destroyed, but some of the inhabitants will be saved (Matt. 24: 35—"Heaven and earth shall pass away, but my words shall not pass away"; John 3: 16—"For God so loved the world, that he gave his only begotten Son, that whosoever believeth in him should not perish, but have everlasting life").

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Fern Prothallia under Cultivation for Twelve Years

THERE is considerable evidence that fern prothallia are like many other plants in that they will extend their life span if kept from reproducing. In 1927, Mottier reported that he had been able to keep prothallia alive for 4 years (*1*). In 1946 the author reported the continuous growing of adventitious prothallia at Marietta College for 7½ years (*2*). A few of these same prothallia were still alive in September 1950, 12 years after the spores were first sown in the flowerpot.

Because of competition of blue-green algae growing in the pot and lack of care during the author's absence, the surviving prothallia died sometime during October 1950. The dead tissue of the remaining prothallia was examined for reproductive organs, since these were reported in the older tissues in 1946 (*2*). Only occasional sporophytes developed after the first year after the spores were sown, and none appeared during the past 5 years. The prothallia maintained themselves by producing lateral proliferations. It is not the purpose of this paper to account for the lack of sporophyte production when reproductive organs were present, but the author believes it is largely due to the fact that there was never enough water around the prothallia for fertilization to take place. The pot was watered by subirrigation; thus, the culture received its water by capillarity from below. Very seldom was there enough moisture for

condensation to be observed on the glass bell-jar.

As Mottier (*1*) suggested, fern gametophytes will probably grow indefinitely if no sporophytes develop. The Marietta plants grew approximately 12 years with very little attention other than watering. This, to the author's knowledge, constitutes a record.

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Individualistic or Statistical Approach?

In the past several months there have appeared in the pages of this journal several brief discussions, discussions that have a far more deep-lying significance than might appear on the surface. Even with due consideration of the risks involved in getting into someone else's argument, I believe that the following lines will clarify the most important point of the controversy (Huntsman, **110**, 566 [1949]; Goulden, **112**, 233 [1950]).

The central point of the argument is the determination of whether an investigation of a physical event carried out by the methods of statistical approach, and dealing with an aggregate of a large number of units, is of more fundamental nature than the investigation based on observation of the more intimate features of the individual units comprising the aggregate.

The logical answer is not a single entity. Thus, the use of statistical methods, per se, has given us many of the commonly known "general" laws used in most branches of physical sciences. No one can argue against the certain degree of utility of such generalizations in our study of the universe. The same universe, however, contains a great many examples that clearly show the inadequacy of the statistical view in applications to *all* problems (as is seemingly desired by one of the parties in the argument). The statistical approach fails utterly to supply us with the basic, fundamental reasons for the events that do take place. To illustrate, a decay curve of a radioactive element is the result of a statistical examination and, as such, may be used to estimate with considerable precision the relative decrease of population of a species. It fails utterly, however, when we try to see the reason why a particular atom, or a number of atoms, suffer degradation whereas their neighbors are unaffected. It seems obvious that some manifestation of incipient event must take place before the atomic catastrophe, unless cause and effect are to be completely discarded. Equally obvious may be the observation that knowledge of the phenomena that precede the event in the individual atom would be of much more fundamental nature than the observations of what happens after the event takes place, especially when only the gross manifestation of a "mob" is observed. To come down to the everyday level, consider the case mentioned by Huntsman, in which a successful insurance applicant passed on to an undoubtedly better world immediately upon receiving his policy. It is a custom of the insurance companies to examine their potential customers with some care, especially when a large sum is involved. Obviously, the man in question must have had some signs of impending doom in his system, yet apparently medical science had no way of detecting or estimating them. Does the fact that the statistical tables indicated a period of X years of life ahead of this man alleviate in any way the impact of the individual's death on his immediate family (or the checkbook of the insurance company)? Obviously, it does not. In addition, the statistical approach tends to close the door upon closer, more intimate, and more individualistic approach to the basic understanding of the reasons for the collective behavior of a mass of units.

If we are to take the reason for the existence of physical science to be our curiosity about the world around us, and if we pose to ourselves the questions "how" and "why," rather than "what," it would appear that the individualistic approach is the more fundamental one. Unfortunately, at this time we are just beginning to tackle the study of the individual material units, and our instruments and devices are too crude. May we hope that the future will see a justification of this view, or else each of us will become the ith component of a statistical mob.

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Errata

We have been informed by the author (Kipnis, F. *Science*, **113**, 40 [1951] that in his Formula XVII, page 42, he omitted – OH at position 5. In the same article, column 1, page 42, the paragraph which begins, "The pseudosapogenins, dihydrosapogenins, etc.," became pied after leaving our hands. This should read: "The pseudosapogenins, dihydrosapogenins and dihydropseudosapogenins, assuming that all have similar ring structures, are named as pseudosapogenans."—Editors.

Book Reviews

The Flora of Bic and the Gaspé Peninsula, Quebec. H. J. Scoggan. Ottawa, Canada: National Museum of Canada, 1950. 399 pp. $1.00.

Following in the footsteps of Fernald and Wynne-Edwards, H. J. Scoggan has devoted himself for a decade to investigation of an area which has been much in controversy from the standpoints of glacial geology and plant geography. His findings are presented in this commendably complete and critical monograph.

Because of its endemics and the peculiar pattern of distribution shown by some of the plants of limestone and serpentine areas, the Gaspé flora is an exceptionally interesting one to students of plant geography. It was first studied in detail by the late M. L. Fernald, whose characteristically intensive field work early in the century resulted in the discovery of most of the unusual plants of the region. Fernald and his co-workers discovered and described 143 new systematic entities (species, varieties, and forms) which had their type localities in the Gaspé peninsula, and, although the ranges of many of them have subsequently been found to be more extensive, others are still regarded as endemics. Their systematic relations, however, are often with western American (Cordilleran) types. Likewise the flora contains a considerable number of plants of disjunct distribution, Laurentian and Cordilleran, although the results of late explorations in hitherto neglected mid-continental areas have tended to close the gaps. Scoggan himself has supplied many new distributional records through a botanical survey made in central Manitoba during the summer of 1948 under the auspices of the National Museum of Canada.

Fernald interpreted the earlier floristic findings in accordance with his well-known hypothesis that the high plateau of central Gaspé was a large nunatak, or nonglaciated refuge, on which a remnant of the flora that preceded Pleistocene glaciation persisted, surrounded by glacial lobes in the St. Lawrence channel to the northward and in the Matapedia Valley and Chaleur Bay to the southward. The consensus now seems to be that the whole region was overridden by the Wisconsin ice sheet, since erratic boulders of distant origin have been found on the highest summits, even though it has not been satisfactorily shown when, in glacial history, they were left there. The conclusion has nevertheless been drawn by Alcock, Wynne-Edwards, and most geologists that the evidence of complete Wisconsin glaciation of the entire peninsula is so great that Fernald's nunatak hypothesis must be abandoned. Even so, it must be borne in mind that the evidence is not too strong that the erratic boulders of the Gaspé mountains were transported during the Wisconsin glaciation and not earlier. The nunatak hypothesis in its most generalized form, as applying to the whole of the period of Pleistocene glaciation, may indeed have been overthrown. Some part of it, however, may still be found useful, for it is scarcely possible that the ice receded uniformly from the south without the appearance of temporary "islands" surrounded by ice and of ice-free coastal strips.

It is conceivable that, even if the Gaspé region were not continuously a refuge for a preglacial eastward outlier of the Cordilleran flora throughout the Pleistocene glaciation, it became such during the period of melting and recession of the ice. On account of its varied altitude and diversified, unoccupied, specialized limestone and serpentine habitats, it may have provided for the establishment and persistence of pioneer plants reaching it by way of the morainic belt, before it became open to general invasion of plants from the widespread eastern continental flora to the south.

Mid-continental disappearance of certain isolated plants of Gaspé, at the same latitude as Gaspé, is accounted for by Scoggan (in agreement with evidence cited by Wynne-Edwards, as well as with new data obtained by Rousseau and Scoggan himself) on the ground that pioneer habitats of the flat central forest country have been swallowed up by the aggressive advance of a more generalized flora from the south, whereas pioneer habitats have persisted along the Gaspé cliffs.

Botanists will find themselves generally in accordance with the ideas of Scoggan, Wynne-Edwards, Cain, and others that the broad morainic belt south of the continental ice sheet "would have served as an ideal refugium for those rare plants that even today are confined chiefly to the unstable sea cliff and river gravel habitats, free from invasion by the forest species that have crowded them out elsewhere." It is indeed significant that the endemics and species of unusual distribution are not those of acid soils and extreme arctic-alpine distribution which might be presumed to have been hardy enough to survive for millennia on a frigid nunatak. On the contrary, they are mostly plants of isolated and lithologically extreme, basic, low-altitude habitats and are more boreal and temperate than arctic in distribution. Moreover, similar calcareous habitats do not all have the same assemblage of rarities, from which it has been argued that we are dealing with new endemism, and that the apparent genetic stability of the types may result from the populations having descended from highly selected, relatively homozygous sources. The idea is not at all unreasonable that the population of certain rare species on habitats made newly available by the retreat of the ice may have been derived from single seeds! Thus genetic stability and population uniformity need not necessarily have come about through ages of rigorous natural selection im-

posed upon genetically diverse populations by habitats gradually approaching limiting conditions for survival, as the situation was interpreted by Fernald. Rather, the chance invasion of unoccupied habitats by the dispersal of accidentally homozygous, initially small and genetically uniform populations has given the aspect of "ancient" endemism and disjunct distribution of long-inbred vestigial types.

It must not be forgotten that newly exposed unleached glacial till at the edge of the receding ice sheet would have contained so much pulverized limestone that it would have provided a temporary habitat for calciphile species.

Anyone interested in the plant geographical problems of the glaciated region will find all the data that pertain to Gaspé admirably assembled in Scoggan's book. As a regional flora it is extremely satisfactory, for the keys will enable the local or visiting botanist to determine most collections without recourse to other books. Space limitations prevent discussion of any systematic details, but in general it appears that Scoggan has found himself botanically in agreement with the conclusions of Fernald and his associates. We are indebted to him and the National Museum of Canada for a fascinating account of an important local flora.

H. H. Bartlett

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Antennas. John D. Kraus. New York: McGraw-Hill, 1950. 553 pp. $8.00.

The day when the antenna for a radio receiver was just any old piece of wire has passed. The philosophy behind this has, however, taken a long time to die. It required the advent of ultra short waves to bring antenna design into true perspective, and to set the subject alongside other aspects of radio engineering as one worth studying for its own merits.

In many present-day radio applications the antenna is the most vital part of the equipment and that on which its whole accuracy depends, the transmitter and receiver being merely a source and detector of power. This is particularly true of radar applications, which have probably done more than anything else to stimulate modern interest in antenna design.

Accordingly, there has arisen a need for a textbook that deals comprehensively with the subject at a level which can be understood by a student in the final years of his university course. The present text, written by one who has by his own research added considerably to our knowledge of the subject, goes far toward meeting this need. The student using the book requires a good grounding in the fundamentals of electromagnetic theory, and some knowledge of physical optics is an advantage, but at no stage is a very advanced mathematical treatment involved.

Antennas covers all aspects of the subject, starting with the properties of point sources and simple linear elements and dealing with combinations of these to form arrays of various types. In order to do this the self and mutual impedances of the elements of the arrays are fully dealt with. Some consideration is given to the fundamental theory of the biconical and cylindrical dipole, but the complex mathematics usually associated with this subject has been omitted. This aspect might have received a fuller treatment, in view of the recent important theoretical advances in this field, but it must be admitted that most of the mathematics involved is beyond the average student.

The theory of antennas acting as sources with a continuous distribution across their aperture is also treated, and many applications to microwave antennas are discussed. It is not surprising that the helical antenna should be treated in some detail in view of the author's important contributions to this subject. One or two subjects of importance receive, however, rather scanty treatment, the most notable being the Yagi aerial, which is now widely used.

References to published work given throughout the text are most useful. These are largely confined to American research and do not include much of the work carried out in England during the war. Recent British publications, however, cover this work rather fully.

The number of textbooks on antennas is not great, and some err by being either so full of engineering details as to obscure the fundamental principles, or so full of mathematics as to leave no room for practical considerations. The author has struck a happy compromise between these viewpoints. *Antennas* can be confidently recommended as a textbook for students of radio engineering and as a reference book for those engaged in research or in engineering practice.

R. A. Smith

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Thoracic Surgery. Richard H. Sweet. Philadelphia: Saunders, 1950. 345 pp. $10.00.

This new book on the techniques of thoracic surgery has been written by one of the recognized leaders in this field in American surgery, and it adds luster to his reputation. The book is "based upon the concept that any properly qualified surgeon can acquire with relative ease a satisfactory proficiency in thoracic surgery by employing the techniques herein described." With this as a starting point Dr. Sweet has written a thoroughly inclusive volume which will lead the interested reader through a rather abbreviated section on the surgical anatomy of the thorax, general considerations of thoracic operations, and finally the techniques of specific operations for specific disorders.

The author's experience in thoracic surgery and his wide knowledge of past and present literature have

been distilled to produce a single volume that admirably covers the broad and still-expanding field of thoracic surgery. Necessarily, a considerable degree of simplification that occasionally approaches unwise abbreviation has ensued. The road to surgical success in the performance of thoracic operations has been clearly outlined, but the surrounding landscape has been eliminated or blurred to the point of being almost absent. This need not be a shortcoming of the book if the reader always keeps in mind his own experience and judgment.

The numerous illustrations, most of which have been done by Rodriguez Arroyo, are of variable quality, but in general are rather lacking in the lucidity that is apparent in the text.

One can certainly recommend this book for the careful reading of anyone interested in the techniques of thoracic surgery. It should also prove profitable reading for the general practitioner or medical chest specialist who could gain a greater understanding of disorders of the chest that are amenable to surgical treatment. Dr. Sweet's purpose in writing the book has been admirably fulfilled, and disappointments are extremely few.

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Elements of Human Physiology. 2nd ed. Miriam Scott Lucas. Philadelphia, Pa.: Lea & Febiger, 1950. 357 pp. $4.75.

This new text in human physiology represents a revision of an earlier one of 1940. Based on long experience in the teaching of undergraduate students, many of the chapters have been quite thoroughly revised and others completely rewritten. The general format of the book remains the same as before.

A number of features stand out in the revision. One is the completely rewritten accounts of the nervous system, where the author has tried to unite more closely than ever its somatic and visceral portions by treating them together, rather than giving the autonomic system its usual chapter by itself. Other features are an expansion of the blood groups to include the Rh factor(s), inclusion of a brief account of aviation physiology in the chapter on respiration, a rewritten account of water balance and body fluids, increased emphasis on the role of absorption as a preliminary to metabolism, a greatly improved account of vitamins, and considerable improvement in the final section on reproduction and endocrines. Last, but not least, are the inclusion of a number of new illustrations and tables, and the appearance of special references at the end of each chapter.

It is the reviewer's opinion that the text has considerable merit as an undergraduate account of human physiology. It is neither too condensed nor too elaborate. The author has kept both the student and the teacher in mind throughout in writing the book. The physiological material has not been overdiluted with anatomy, as often happens in a book of this type, yet there are anatomical accounts where needed. The style of writing is generally clear. As in all revised texts, some errors in typography still remain, and new ones creep in during revision. The discerning reader will also note several mistakes in fact or impression, again not unusual for a textbook. For example, 10^{-7} is not the negative logarithm of pure water at 22° C (p. 125); the "neosensibilities" of Brouwer include certain exteroceptive pathways as well as proprioceptive (p. 79); not *all* enzymes (with the exception of rennin) are hydrolytic enzymes; this should have been qualified with the word "digestive" (p. 206). As far as the reviewer is aware, uric acid is not formed in the intestine from nucleic acids (p. 273); it is questionable whether bile salts aid pancreatic enzymes in protein digestion, unless the author means indirectly through the facilitation of fat digestion (p. 221).

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Scientific Book Register

Stress. Hans Selye. Montreal, Canada: Acta Endocrinologica, 1950. 1,025 pp. $14.00.

Handbook of South American Indians: Physical Anthropology, Linguistics and Cultural Geography of South American Indians, Vol. 6. Smithsonian Institution, Bureau of American Ethnology, Bull. 143. Julian H. Steward, Ed. Washington, D. C.: U. S. Government Printing Office, 1950. 715 pp. $5.00.

The Enzymes: Chemistry and Mechanism of Action, Vol. I, Part 1. James B. Sumner and Karl Myrbäck, Eds. New York: Academic Press, 1950. 724 pp. $13.50.

Contributions to the Theory of Games. Annals of Mathematics Studies, No. 24. H. W. Kuhn and A. W. Tucker, Eds. Princeton, N. J.: Princeton Univ. Press, 1950. 201 pp. $3.00.

Gmelins Handbuch der Anorganischen Chemie: Antimon, Teil A. Weinheim-Bergstrasse, Germany: Verlag Chemie, 1950. Pp. 303–351. DM 16.50.

The Neural Crest: Its Properties and Derivatives in the Light of Experimental Research. Sven Hörstadius. New York: Oxford Univ. Press, 1950. 111 pp. $3.00.

Plant Pathology. John Charles Walker. New York: McGraw-Hill, 1950. 699 pp. $7.50.

Classical Mechanics. H. C. Corben and Philip Stehle. New York: Wiley; London: Chapman & Hall, 1950. 388 pp. $6.50.

Elements of Fractional Distillation. 4th ed. Clark Shove Robinson and Edwin Richard Gilliland. New York: McGraw-Hill, 1950. 492 pp. $7.00.

The Chemistry of the Nonbenzenoid Hydrocarbons. 2nd ed. Benjamin T. Brooks. New York: Reinhold, 1950. 615 pp. $12.00.

Handbook of Antibiotics. A. L. Baron. New York: Reinhold, 1950. 303 pp. $6.50.

News and Notes

Higher Education in the National Service

Francis J. Brown

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On October 6 and 7 the American Council on Education convened its third conference since the 38th Parallel was crossed on June 25, on the relationships of higher education and government in the expanding emergency. The first was on July 7 when the officers of national organizations in higher education with headquarters in Washington met with representatives of the Office of Secretary of Defense, the National Security Resources Board, the U. S. Office of Education, National Headquarters Selective Service System, and the Research and Development Board. This meeting was a preliminary exploration of the possible effects of the mobilization that was still in the very early stages of planning.

The second meeting, which included the same governmental agencies, a larger number of national educational organizations, and some 25 college and university presidents, was held on August 5. By this time it was evident that mobilization would soon begin to affect many aspects of our lives, and that colleges and universities would be faced with increasingly serious problems in rendering maximum service to the nation. Based upon these preliminary explorations and joint discussions, it was decided that a national conference be called by the American Council on Education the first week of October.

The October 6–7 conference was unique in several respects. It was deliberately called prior to the determination of policies and the formulation of specific programs by the various agencies of government in order that colleges and universities might share with government the responsibility for the formulation of policies and the development of programs.

It was unique also in that the personnel attending the conference, as well as its organization, made such joint planning possible. Of the 974 persons in attendance, approximately 600 represented specific colleges or universities, 400 being presidents of their institutions. Ninety-one national organizations were represented, including not only all in the field of higher education but also civic, labor, farm, and veterans' organizations that have a vital interest in higher education. There were 140 representatives from 23 departments and agencies of the Federal government. For each of the ten sections a panel of consultants provided direct exchange of points of view between representatives of higher education and of government.

At the opening plenary meeting, a letter from the President of the United States to the conference was read, and seven speakers gave an excellent general background for the discussions that took place in the section meetings on Friday afternoon and Saturday morning. The section chairmen reported back to the last general session on Saturday afternoon, when their reports were unanimously received and general resolutions adopted.

The general problems discussed in the ten sections, which met concurrently, were: Military and Other Training Programs, addressed by representatives of the Air Force, Army, and Navy; Research; Contractual Relations with Governmental Agencies; Allocation of Materiel; Manpower Utilization; Policies Relating to Student Admission and Withdrawal; Acceleration; Civil Defense; Continuing Essentials of Higher Education; and Education for International Responsibilities.

The third unique aspect of the conference was that its emphasis was the extent to which higher education could and should continue to meet the twofold challenge—that of the present and continuing emergency and the long-range needs of the nation for manpower equipped for leadership in every aspect of our national life.

The following general resolutions adopted unanimously by the conference provide a concise summary of its deliberations and its recommendations both to government and to higher education.

In this crisis and turning point in American and world history this Conference reaffirms the declaration made at the 1942 Conference on Higher Education and the War:

> We pledge to The President of the United States, Commander-in-Chief of our Nation, the total strength of our colleges and universities, our faculties, our students, our administrative organizations, and our physical facilities.

To carry forward the application of these principles to the grave problems now facing higher education in America this Conference, again called by the American Council on Education, adopts the following declarations:

1. The greatest power of the nation lies in well-educated and well-trained men and women. To increase this power, it is imperative that opportunities for higher education for secondary school graduates of superior ability be substantially increased, irrespective of race, creed or economic status.

We pledge the maintenance of high educational standards.

A properly safeguarded student deferment policy is in the national interest. Such deferment should employ measures of individual aptitude and capacity and also take cognizance of the continuing educational performance of the individual. It should not be based on courses or curricula leading to specific professions or vocations, except in so far as such specific deferment is now established by law or directive or shall later be judged to be necessary in the national interest. There is an obligation

on the part of deferred students to serve in the armed forces or in other work of national importance on the completion of their education.

2. In order that all available facilities of institutions of higher education may be used to the maximum extent in the service of the nation, we recommend that a detailed survey of such facilities be undertaken as soon as practicable.

It is imperative that any program of priorities and allocations which may be established by the government include educational institutions at a sufficiently high priority level so that they may further effectively render essential services for national defense and public welfare.

3. Basic research in all fields of knowledge should continue unabated. Universities must, in all probability, undertake an increasing amount of applied research of military interest. We commend the principles and policies under which the Office of Naval Research has been conducted as exemplifying satisfactory relationships between universities and government agencies.

4. We recommend that colleges and universities assume their full responsibilities as community and educational leaders in the program of civil defense.

5. We pledge the resources of higher education to define and promulgate the principles of American democracy both among our own people and to the other peoples of the world. Furthermore, we welcome the cooperation of Federal agencies in strengthening programs for international responsibilities, particularly in the Far East.

6. Finally, the Conference directs the standing committees of the American Council on Education to continue the study of the topics discussed in these resolutions and in the reports of our special section meetings and urges the Council to participate actively in the continuing process of national planning concerning all aspects of the relationships between higher education and the Federal government in these days of crisis.

The conference, with its broad representation of higher education and of government, developed a mutual understanding of each other's problems. It was a demonstration of their joint planning that will now be continued through the American Council on Education Committee on the Relationships of Higher Education to the Federal government in its frequent meetings with representatives of government. The membership of this committee includes wide representation from all types of institutions of higher education and of geographic regions, and the executive officers of the national educational organizations interested in higher education with headquarters in Washington are consultants to the committee. The meeting on January 19 and 20 of the representatives of all the 131 national educational organizations that are members of the council provided another opportunity to appraise developments in the relationships of higher education and of government, and jointly to formulate such further policies as seemed desirable.

American higher education faces one of the most serious periods in its history. The duration of the present conflict will not be the eighteen months of World War I, nor the five years of World War II. We may well be entering upon the Thirty Years War of the twentieth century. But victory in the present conflict will rest not alone upon the strength of the military arm of our nation nor of all of the democratic countries of the United Nations. We are combating the ideology of Communism as well as its political states. In this ideological conflict we and all other democratic nations must not lose sight of the long-range values of the democratic way of life. These must not only be preserved and strengthened at home but developed also throughout the world. Higher education is destined to play an important role in the national service.

Scientists in the News

R. H. Bogue, director of the Portland Cement Association Fellowship at the National Bureau of Standards, is in Europe for a two-month visit, having been invited to give a series of lectures at the Instituto Tecnico de la Construccion y del Cemente in Madrid.

Bradford N. Craver has joined the Johnson & Johnson Research Foundation as director of pharmacology. He was formerly with Ciba Pharmaceutical Products, Inc., and the Manhattan Engineering Project. Dr. Craver will be responsible for an expanded program of pharmacological research and will serve both Johnson & Johnson and Ethicon Sutures Laboratories.

Frank C. Foley, District Geologist, U. S. Geological Survey, Madison, Wis., has been appointed geologist and head of the Division of Groundwater Geology and Geophysical Exploration, Illinois State Geological Survey, succeeding **Carl A. Bays,** resigned, and as research professor of geology, University of Illinois. This combined position will include state-wide research on groundwater geology and the direction of graduate training in groundwater geology at the University of Illinois, in response to the need for trained specialists. He will assume his new duties sometime this spring.

E. Raymond Hall, chairman of the Department of Zoology, and director of the Museum of Natural History, University of Kansas, is on sabbatical leave for the current academic year and for next summer. Dr. Hall is engaged in studies of North American mammals at the U. S. National Museum, Washington, D. C.

Milton A. Lessler, formerly National Cancer Institute Research Fellow at the New York University, has been appointed assistant professor of physiology at Ohio State University.

Donald B. McMullen, professor of preventive medicine, University of Oklahoma School of Medicine, recently returned to the U. S. after spending four months in Yamanashi Prefecture, Japan, testing chemicals for their molluscacidal activity. *Oncomelania nosophora,* the intermediate host for *Schistosoma japonicum,* was used in screening 4,379 chemicals. Funds for the project were provided by the

Army Medical Research and Development Board.

Philip E. Nelbach, New Haven, Conn., has been appointed director of the National Health Council, an association of 31 national health agencies and professional societies. Mr. Nelbach has recently completed five years as a public health director of the American Friends of Yugoslavia, Inc. He also served four years as assistant professor of public health at Yale University School of Medicine, and with the American Public Health Association.

A key figure in the nation's chemical warfare program in World War II, **W. Albert Noyes, Jr.,** chairman of the University of Rochester's Chemistry Department, has been appointed chief scientific adviser to Major General Anthony C. McAuliffe, chief of the U. S. Chemical Corps. Dr. Noyes will continue his duties at the university, but will spend at least two days a week in Washington. Since World War II he has served as chairman of the Naval Research Advisory Committee and of the Division of Chemical Technology, NRC, as a member of the Chemistry Panel of the AEC, and as adviser to the Office of Civil Defense Planning to study the technological aspects of radiological defense. Dr. Noyes is a past president of the American Chemical Society and is now editor of *Chemical Reviews* and the *Journal of the ACS.*

Wolfgang K. H. Panofsky and **Willis E. Lamb, Jr.,** specialists in atomic and nuclear physics, will shortly join the Stanford faculty. Dr. Panofsky, with the Radiation Laboratory and Physics Department of the University of California at Berkeley, will assume his new duties July 1; Dr. Lamb, professor of physics at Columbia, will become visiting professor of physics starting September 1.

George W. Pearce, associate professor of chemistry of the New York State Agricultural Experiment Station of Cornell University, at Geneva, N. Y., has been spending his sabbatical leave with the U. S. Public Health Service at Savannah, Ga. He is working on formulations and analytical methods for economic poisons with the Technical Development Services of the Communicable Disease Center.

After 45 years of volunteer teaching in the University of Cincinnati College of Medicine, **J. Louis Ransohoff** has retired under the university's automatic retirement rule. The university Board of Directors has granted him the honorary faculty title of clinical professor emeritus of surgery. Dr. Ransohoff has been on the university's medical staff since 1905 and became professor of clinical surgery in 1925. He will continue in private practice.

S. S. Sidhu, director of the Cooperative X-ray Laboratory of the University of Pittsburgh, has resigned his position at the university and joined the Argonne National Laboratory as a senior physicist. Dr. Sidhu worked for the Argonne National Laboratory during 1947–48 while he was on leave of absence from the university, and was a consultant to the laboratory before rejoining it.

R. Dale Smith, formerly associate professor of anatomy at the University of Maryland Medical School, has been appointed head of the Department of Anatomy at the Creighton University School of Medicine.

Awards

Gladys A. Anslow, professor of physics at Smith, has received the top scientific award for women—**Research Award** of Sigma Delta Epsilon—for her work on the spectrochemical study of the structure of protein molecules, a knowledge of which is essential for production of synthetic foods and other proteins. The prize was presented during the AAAS meeting in Cleveland last December.

Deadline for entries in the 1950 competition for the annual **Lasker Awards for Journalism** is *February 15.* Newspapermen and magazine writers who have written health or medical articles during the calendar year are eligible. Entry blanks and other information may be obtained from the Nieman Foundation for Journalism, administrators of the awards, at 44 Holyoke House, Cambridge 38, Mass.

Fellowships

The **NRC Committee for Research in Problems of Sex** is offering new grants-in-aid for the fiscal period July 1, 1951–June 30, 1952. Applications will be received until *March 15, 1951.* Blanks may be obtained from the Division of Medical Sciences, NRC, 2101 Constitution Ave., Washington 25, D. C.

The **ONR** is offering grants-in-aid of basic research in marine, estuarine, and fresh-water biology and in microbiology. For information address either Biology or Microbiology Branch, ONR, Department of the Navy, Washington 25, D. C.

The **University of Utah** is offering research fellowships and assistantships for graduate students in the following departments: Biological Sciences, Chemistry, Mathematics, Physics, and Psychology, and the colleges of Medicine, Education, Engineering, and Mines and Mineral Industries. Stipends range from $500 to $1,200. Applications may be obtained from the Dean, Graduate School, and should be submitted before *March 1.*

Under the direction of David E. Green and Henry Lardy the **National Heart Institute,** USPHS, is conducting a research training program in enzyme chemistry, with particular reference to heart muscle, at the Institute for Enzyme Research of the University of Wisconsin. Stipends are the usual ones in effect for postdoctoral research fellows of PHS, plus travel allowances. Only 10 candidates per year will be accepted. Trainees may start any time during the period July 1951–July 1952. For application forms and

other information, write to Dr. David E. Green, Institute for Enzyme Research, University of Wisconsin, Madison.

Meetings

Hugh M. Sinclair, professor of nutrition, University of Oxford, will deliver the **Cutter Lecture on Preventive Medicine** at Harvard Medical School on February 9. Dr. Sinclair will speak on "Nutrition Surveys of Population Groups."

The **American Association of Economic Entomologists** and the **Entomological Society of America**, meeting in Denver last December, voted to accept in principle the findings of a joint committee on consolidation. The membership will be asked to decide by ballot whether entomology in the U. S. will in the future be represented by one organization.

The next **General Symposium of the Faraday Society**, to be held in Oxford, April 11–13, will deal with hydrocarbons. The **Fall Symposium** has been advanced to the last week of July so that members may attend the various international meetings to be held in the U. S. during September. American visitors planning to attend the Faraday Symposia should communicate at once with the Society at 6 Grays Inn Sq., London, W. C. 1.

The annual **E. Starr Judd Lecture** at the medical school of the University of Minnesota will be given by Emile Holman, professor of surgery, Stanford University School of Medicine, San Francisco, February 15. Dr. Holman's subject will be "The Surgical Treatment of Constrictive Pericarditis; Clinical and Experimental Observations."

The annual **Congress on Medical Education and Licensure**, conducted by the Council on Medical Education and Hospitals and the Federation of State Medical Boards of the U. S., will be held February 12–13 at the Palmer House, Chicago. An open meeting of the Advisory Board for Medical Specialties will be held February 11.

Manpower

S. 1–H. R. 1752. On January 18 Senator Johnson of Texas introduced into the Senate Amendments to the Selective Service Act of 1948. Substituting for a bill introduced on January 8 by Senator Russell, the Amendments are distinguished by being the first piece of legislation in the 82d Congress, bearing the number S. 1. A companion bill, H. R. 1752, has been introduced into the House of Representatives.

The proposed legislation changes the name of the Selective Service Act to the Universal Military Service and Training Act and lowers the age of induction from nineteen to eighteen. It sets forth the principles that

adequate provision for national security requires maximum effort in the fields of scientific research and development, health, and education, and the fullest possible development and utilization of the Nation's technological, scientific, and other critical manpower resources . . . that it is the duty of all citizens to engage in training for civilian and military service and to prepare for the assumption of their responsibilities as citizens of a free and democratic Nation and to provide a continuing flow of personnel recently trained in modern techniques to assure a vital, ready reservoir to fill the military and civilian needs of the Nation including civil defense.

The period of active service for trainees is set at 27 consecutive months, with reserve status continuing for a total of 8 years. The President is, however, authorized until

June 30, 1954, to provide for the temporary removal from active training and service upon completion of their initial periods of basic training in the Armed Forces of not to exceed seventy-five thousand persons annually, who shall be selected by such civilian officials or agencies of the Government as the President may designate, in order to permit such persons to engage in study or research in medicine, the sciences, engineering, the humanities, and other fields determined by him to be in the national interest and while so engaged such persons shall not be deemed to be in military service (active or inactive) for any purpose; (B) to suspend for such persons the obligation to complete the period of military service required until the completion of such study or research.

Additional numbers may be similarly deferred for officer training, and deferment until the end of the academic year will be automatically granted to college students who reach their eighteenth birthday during the school year

Cosponsored by Senators Russell, Chapman, Kefauver, Hunt, Stennis, Bridges, Saltonstall, Morse, Knowland, Cain, and Flanders, the bill clearly foreshadows the ultimate legislation under which educational institutions and students may expect to plan and to operate.

General Marshall has announced a new basic policy for enlistment in the armed services by college students. The policy is intended to prevent the waste to the nation and the damage to the educational system that is involved in having young men leave school in mid-term because they desire to enlist in the service of their choice before they are called for pre-induction physical examination by their local draft boards. Under the old rules no armed service would accept a voluntary enlistment after a man had received notice to report for his pre-induction physical examination. The new policy provides that students enrolled in colleges or universities and thus automatically entitled to deferment for the school year in which they receive their induction notice, shall be allowed, to the extent of available openings in each service, to enlist in the service of their choice at any time in the two months immediately preceding the final month of their school year. Services accepting enlistments during this two-month period would not call the students to duty until they had finished their school year.

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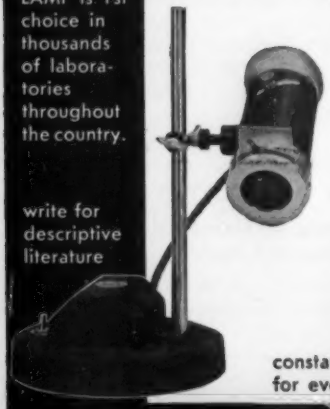

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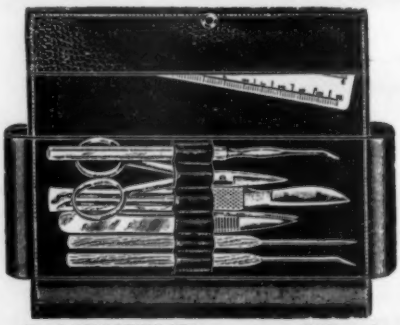

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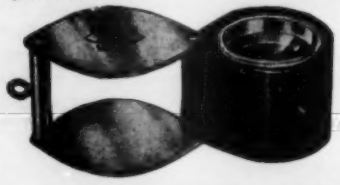

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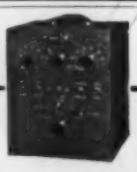
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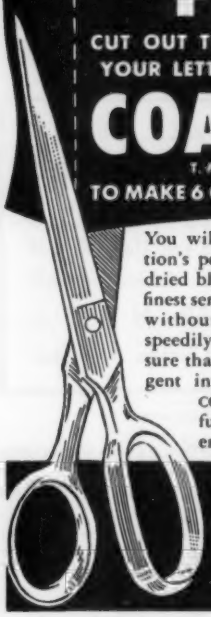

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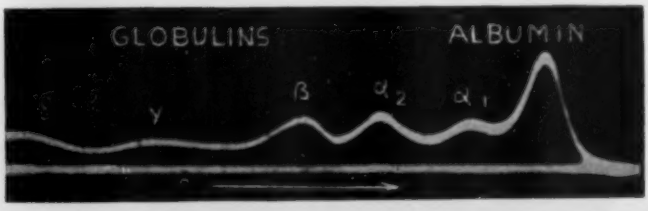

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